WATER WORKS & SEWERAGE

ONE OF TUCSON'S
"DOS TANKOS GRANDES"

A SPADE is one of the oldest tools known to man and still very handy when it comes to leveling off the bottom of a trench. But trench hoes and bulldozers have largely displaced the spade in the construction of cast iron pipe lines. Cast iron pipe is likewise one of the oldest materials for underground mains. Yet, in three centuries, no other type of pipe has usurped its place as the *standard* material for underground mains. Super-de Lavaud *chill-free* centrifugally cast iron pipe is the same standard material produced by improved and carefully controlled casting methods.

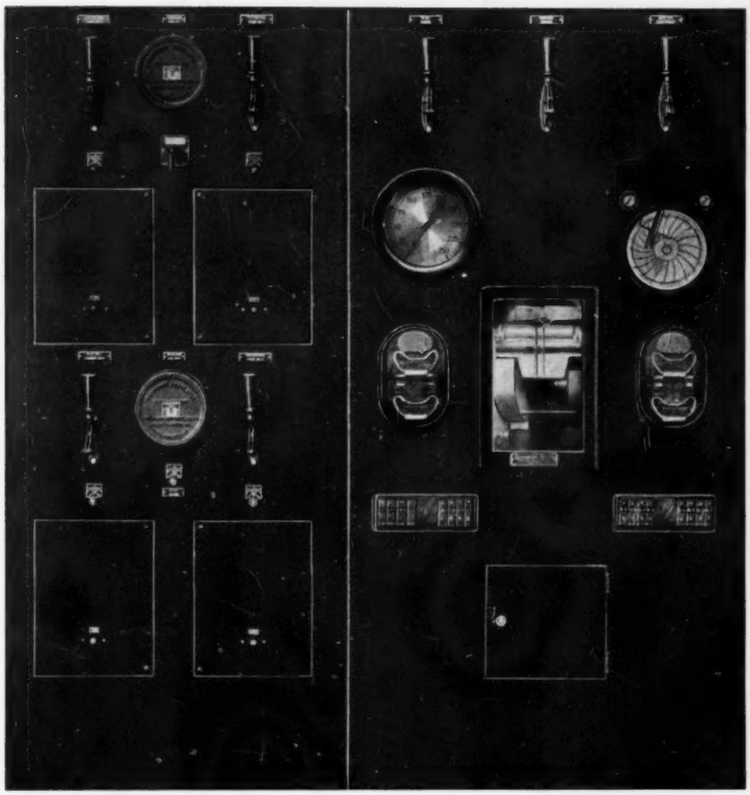
U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S. cast iron PIPE

Centrifugally or Pit Cast for water works, gas, sewerage, drainage and industrial services.

Copyright, 1940 U. S. Pipe & Foundry Co.

2-20 HP, & 2-30 HP, 220 VOLT, 3 PHASE, 60 CYCLE MOTORS CONTROLLED BY CLARK-SUNDH DEAD FRONT PANEL



¶ One Panel of this Dead Front Steel Switch Board houses 2-20 HP and 2-30 HP, 220 Volt, 3 phase, 60 cycle, Across-the-Line type Motor Starters, equipped with Manual Testing Switch, independent of the Automatic operation.

¶ The 2-30 HP Motors operate a deep Well Centrifugal and a Boost Pump, both Pilot Switch operated by Float Switch Control.

¶ The 2-20 HP Centrifugal Booster Pumps are operated by Pressure Control with transfer facilities for interchanging the 2 Bourdon Tube Type Regulators with the 2 motor starters.

¶ The other panel houses the incoming line, metering, recording, and lighting distribution section.

¶ All Knife Switches and Transfer Switches are externally operated without live parts on front of board, providing operator protection as well as motor protection.

¶ Typical of the neatness and efficiency of Clark-Sundh Control apparatus, this Dead-Front Steel Switch Board effectually helps keep a Mid-West city Water Works operating efficiently.

¶ For Water Works and Sewage Disposal Plant electrical control, please contact our nearest office.

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

WATER WORKS & SEWERAGE, November, 1940. Volume 87. Number 11. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada $2.40 per year; Foreign $3.00 per year. Copyright, 1940. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

You wouldn't buy shoes on **CLAIMS** . . . you try them on before you buy

WHY DEPEND ON CLAIMS FOR ACTIVATED CARBON . . . WHEN YOU CAN TEST ITS *PERFORMANCE* ON THE WATER YOU HAVE TO TREAT!

There's no "Believe It or Not" about buying activated carbon when you check *performance* with the Threshold Odor Test, the Carbon Feed Chart, and the Darcograph.

With these scientific methods, you can pick the best carbon for your plant. You can check the uniformity of each shipment, and you can compare the effectiveness of different methods of application.

Before you place your next order for activated carbon, make these performance tests. You'll find that HYDRODARCO gives best palatability control per dollar on the water you have to treat!

Write for further information — and for a sample of HYDRODARCO, the activated carbon specially made for water treatment.

Hydrodarco Reg. U. S. Pat. Off.

HYDRODARCO

To protect against sifting, Hydrodarco is packed in new-style bags sealed and taped with Latex tape.

DARCO

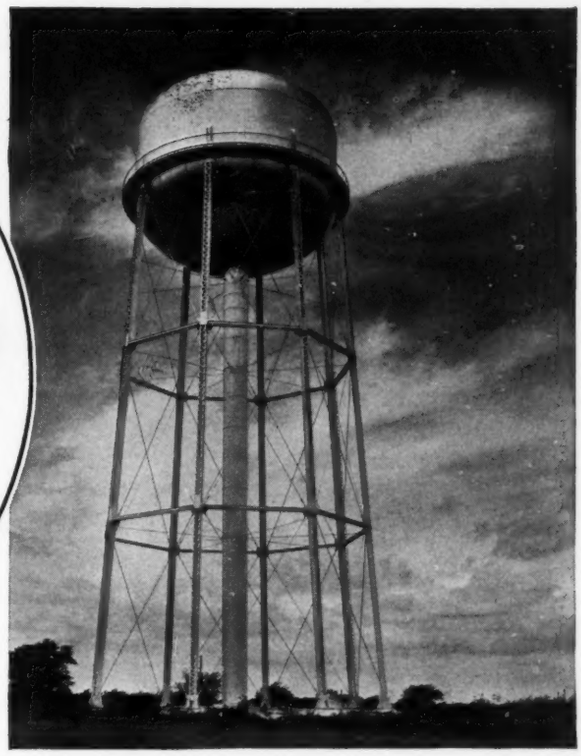
DARCO CORPORATION

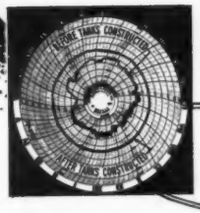
60 East 42nd Street, New York, N. Y.

Distributing Points

NEW YORK • BUFFALO
CINCINNATI • CHICAGO
ST. LOUIS • KANSAS CITY
SAN FRANCISCO
LOS ANGELES
• MARSHALL, TEXAS •

TEMPLE TEXAS IMPROVES SERVICE AND INCREASES FIRE PROTECTION





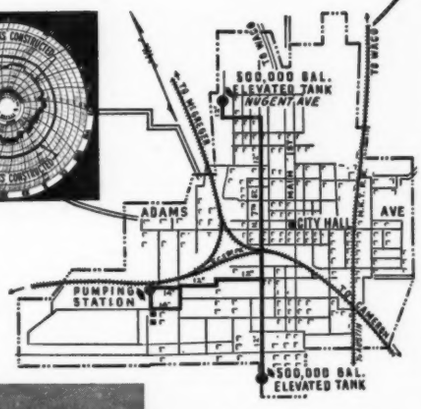
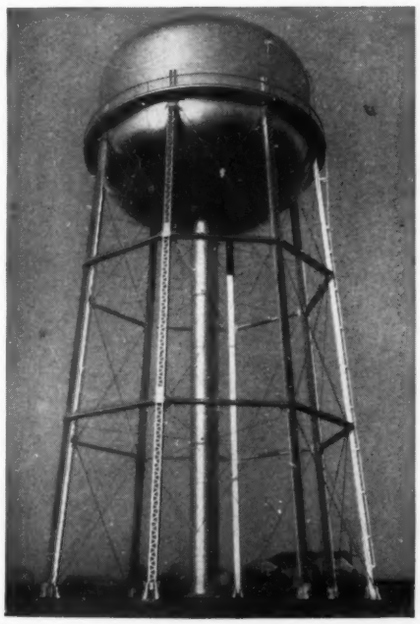


Chart shows the pressure variations in a residential section before and after the two new tanks were installed. Map shows the location of the tanks and the pumping station.

with TWO ELEVATED TANKS

TEMPLE, Texas, a city of 18,172 population, now has a thoroughly modern water supply system, augmented by two 500,000-gal. Horton elevated storage tanks. Previous to the installation of these two new tanks, water pressure was first provided by a 300,000-gal. standpipe and later by means of direct pressure from booster pumps.

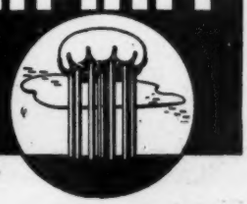


To meet the requirements of the State Fire Insurance Department, it was necessary to provide one million gallons of clear water storage, and an average pressure of 60 lbs. per sq. in. in the business district. The topography of Temple is such that there are high areas on the north and south sides, divided fairly evenly. To balance the demand and pressure, two elevated tanks were installed, one 500,000-gal. unit on the north side and another of equal capacity on the south side. Due to the difference in elevation in the two sites, the north tank is 125 ft. to the overflow and the south tank 151.5 ft. With the overflow pipes at the same elevation both tanks maintain their maximum capacities at the same level.

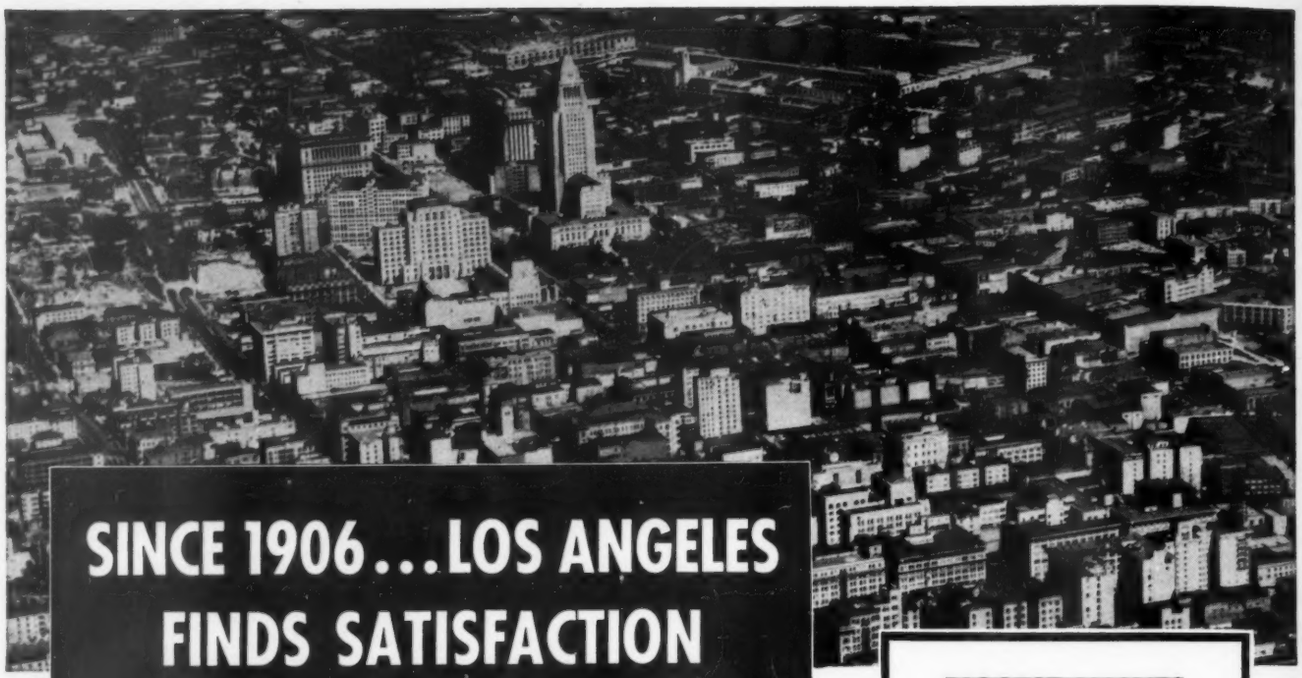
Here is another example of the important part being played by elevated storage in municipal water supply systems. Write for further information.

CHICAGO BRIDGE & IRON COMPANY

Chicago . . . . . 2198 McCormick Bldg.
New York . . . . 3390-165 Broadway Bldg.
Cleveland . . . . 2262 Rockefeller Bldg.
Dallas . . . . . 1679 Praetorian Bldg.
Birmingham . . . . 1586 North 50th Street
Tulsa . . . . . 1646 Hunt Bldg.
Houston . . . . . 918 Richmond Avenue
Detroit . . . . . 1551 Lafayette Bldg.
Philadelphia . . . . 1644-1700 Walnut St.
Boston . . 1548 Consolidated Gas Bldg.
San Francisco . . . . . 1083 Rialto Bldg.
Los Angeles . . . . . 1455 Wm. Fox Bldg.



Plants at BIRMINGHAM, CHICAGO, and GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.



SINCE 1906...LOS ANGELES FINDS SATISFACTION IN CRANE VALVES

34 years of TROUBLE-FREE SERVICE proves the economy of PREVENTIVE MAINTENANCE

BECAUSE of the physical characteristics of lower California, the City of Los Angeles water system operates at extremely high pressure. Thus, naturally, extra stamina is looked for in valves.

Back in 1906 when extensions were made, Los Angeles chose Crane 36″ valves. More than 30 years later, the wisdom of this choice is proved. Read what the Chief Engineer of the Los Angeles Bureau of Water Works & Supply recently said: ". . . regarding the Crane valves . . . installed some thirty years ago . . . we have had no trouble of any kind in connection with their operation, except for usual care given to any valve. (Crane valves) meet all requirements . . . are considered very satisfactory."

It was Preventive Maintenance that Los Angeles applied in 1906. It counseled valves that were designed for a specific need—valves whose superior qualities assured economical performance in that service.

Today, every water works and sewage plant can enjoy the full advantages of Preventive Maintenance throughout its system. That's because Crane can supply the right equipment for every operating condition.

Whether you need valves or sluice gates, large or small, you can get them from Crane. You also get sound assurance that in design, in materials, in manufacture as well, they are engineered exactly for the service you require. And there lies the secret of dependable and low-cost flow control.

No matter if your system is large or small, you can't afford to pass up the economy of Preventive Maintenance. Talk it over with your Crane Representative.

BIGGEST VALVES IN BIGGEST SYSTEMS ARE CRANE VALVES

★

You'll find big Crane valves everywhere—in the nation's largest water works and sewage systems. That's because Crane Quality in big valves is *proved* quality—just as in small and medium size water control equipment.

When you order a valve of any size from Crane, rest assured that it will measure up in every way to your expectations of quality and behavior in service. Its workmanship throughout will be worthy of your confidence, worthy, too, of the name Crane and the greater value it typifies.

For safe, sure, and economical control of your big lines down through the years, Preventive Maintenance counsels big Crane valves. Ask your Crane Representative more about them.

1940 our 85th YEAR

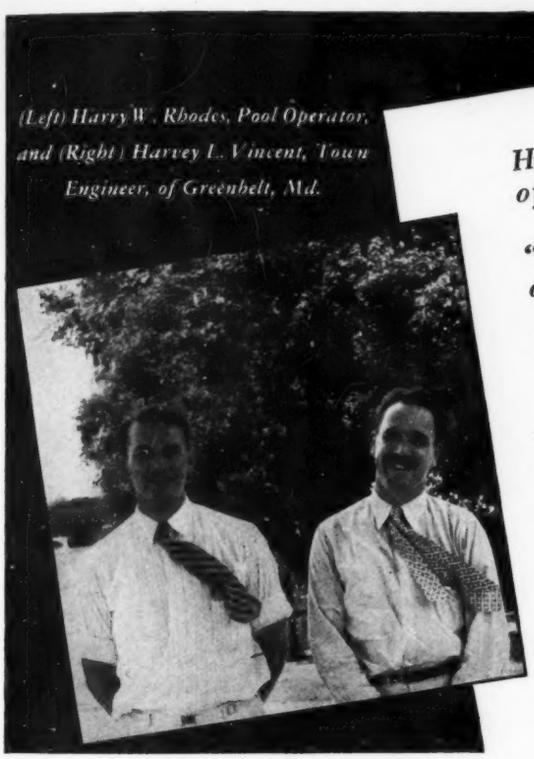
CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Successful Municipal Management
DEMANDS DEPENDABLE SOURCES OF SUPPLY



(Left) Harry W. Rhodes, Pool Operator, and (Right) Harvey L. Vincent, Town Engineer, of Greenbelt, Md.

Harvey L. Vincent, Town Engineer of the Town of Greenbelt, Maryland, says:

"We have been using HTH in several ways since our operations started in 1938.

"We keep a good supply of this product on hand and consider it a stand-by source of chlorine in case we encounter any trouble with the chlorination equipment at either the swimming pool or the sewage treatment plant.

"We also use your liquid chlorine for sewage treatment plant operations, and are glad to take this opportunity to express our appreciation of the good service which your organization has given us. Dependable sources of supply are an important asset in the successful management of community and municipal services."

● Greenbelt, Md. typifies the modern suburb. And its Town Engineer, Mr. H. L. Vincent, expresses the modern point of view in his appreciation of Mathieson sanitation service. Trouble-free containers and valves, and prompt delivery service, keep Mathieson Chlorine in tune with modern ideas of efficiency. HTH offers a dry, free-flowing chlorine carrier delivering over 70% available chlorine—quick, handy sterilizer for many special and emergency jobs.

Greenbelt's community swimming pool and surroundings are also kept sanitary the modern, efficient way—with Mathieson Chlorine and HTH.

But most of all, you will appreciate —as do hundreds of other sanitary engineers—the dependability of Mathieson as a source of supply, a dependability established for nearly fifty years.

HTH comes in 5 lb. cans with replaceable caps, packed 9 cans to the case; also in 100-lb. drums.

THE Mathieson Alkali Works (INC)

60 EAST 42ND STREET, NEW YORK, N. Y.

LIQUID CHLORINE . . . HTH . . . SODA ASH . . . CAUSTIC SODA . . . BLEACHING POWDER . . . BICARBONATE OF SODA . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS (FUSED ALKALI) . . . DRY ICE . . . CARBONIC GAS

THAT NUT'S IMPORTANT! It prevents anyone from forcing the Mathews Hydrant by opening it too far. Just one of the many details which make Mathews Hydrants the safest, surest, most trouble-free fire protection that can be made.
WHY STOP THERE? Mention how the working parts are protected by this shield operating nut from rain, hose spray, and snow. Go on and tell people that EVERY friction point has at least one bronze surface, that plenty of Mathews Hydrants have seen over 70 years' service.
Study the cross-section at the right. Notice how all working parts, as a unit, can be unscrewed from the elbow and lifted out through a loose protection case. This means extra strength, easy repair or overhaul, and NO DIGGING —ever.

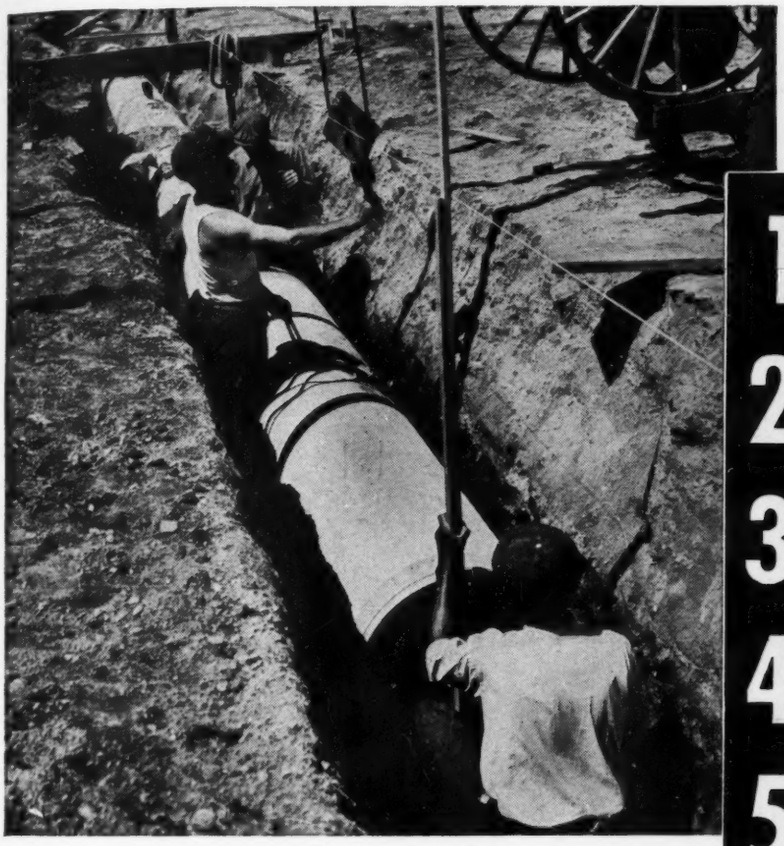
MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

Manufacturers of Sand Spun Pipe (centrifugally cast in sand molds) and R. D. Wood heavy-duty gate valves for water works

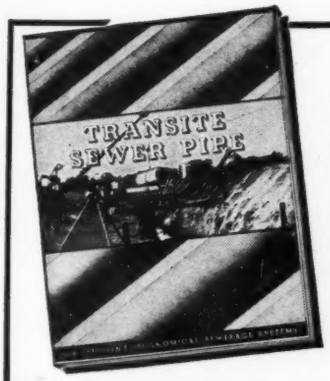
400 CHESTNUT STREET, PHILADELPHIA, PA.

A 5-POINT SAVING IN SEWER-LINE COSTS



TRANSITE'S LONG LENGTHS facilitate laying pipe to accurate grades, speed up installation and reduce the number of joints in the line.

1. SHALLOWER TRENCHES
2. SMALLER PIPE
3. FEWER JOINTS
4. LESS INFILTRATION
5. LOWER MAINTENANCE COSTS



WRITE FOR YOUR FREE COPY OF THIS NEW BROCHURE

LOOKING for lasting sewer-line savings? Check the advantages of J-M Transite—the asbestos-cement sewer pipe. You'll see how this modern material provides important savings on all the above points.

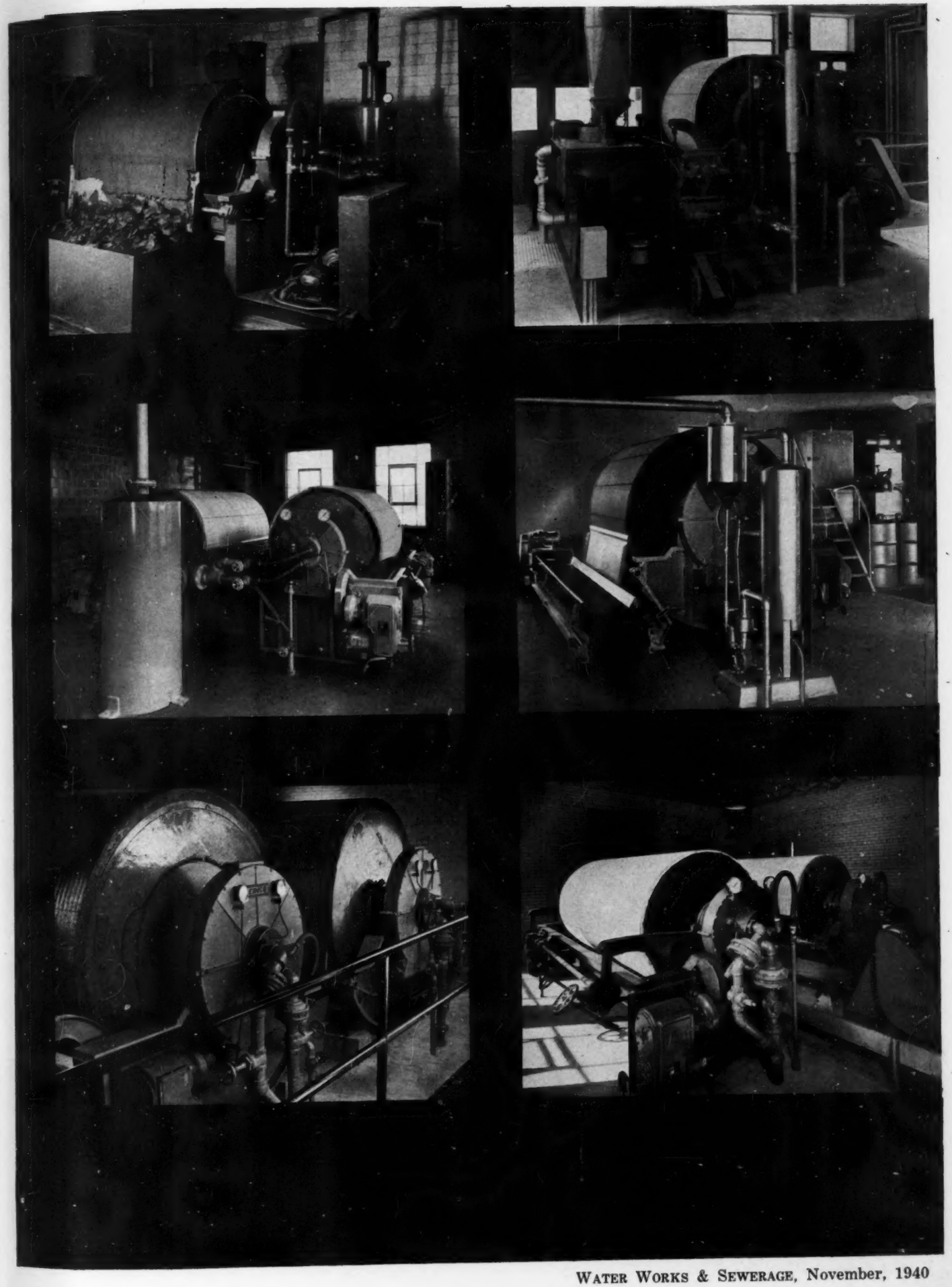
In municipal sewer systems, Transite's high flow coefficient, tight joints, corrosion resistance and uniform strength are establishing a new standard for efficient, economical service.

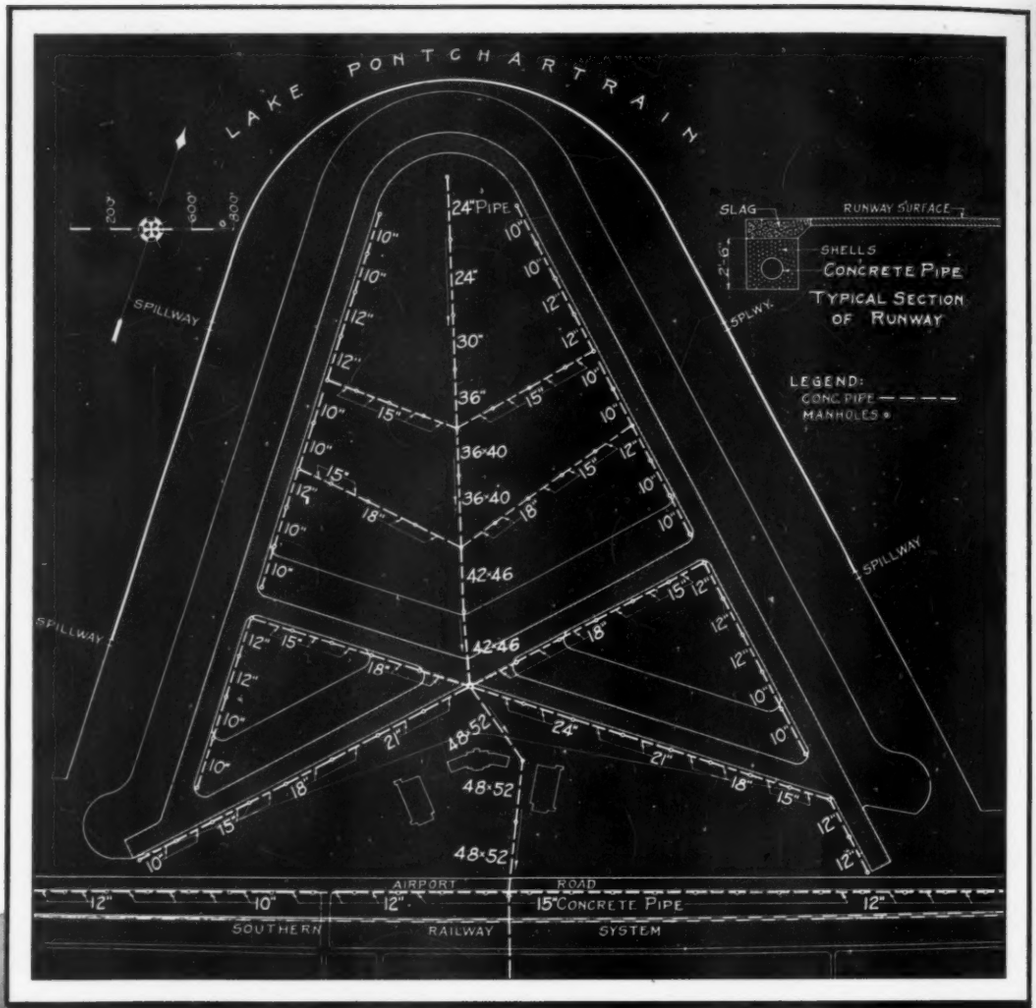
The facts about J-M Transite Pipe are interesting and convincing. You should have full details before planning new sewer lines or modernizing old ones. Write for Sewer Pipe brochure, TR-21A, to Johns-Manville, 22 E. 40th St., New York, N. Y.

Johns-Manville TRANSITE PIPE

THE MODERN MATERIAL FOR SEWER AND WATER LINES

EIMCO





New Orleans Airport. More than 25,000 ft. of concrete sewer and reinforced concrete sewer pipe was used in the drainage system shown. Pipe lines, ranging in diameter from 10-in. to 48-in., are built on adequate grades to provide self-cleansing velocities, and are adequate in capacity to insure quick run-off. Entire system in excellent structural condition today.

(Below) *Buffalo, N. Y., Municipal Airport.* Constructing a 36-in. reinforced concrete pipe intercepting drain.

For Airport Drainage Jobs... *play safe with* CONCRETE PIPE

Modern airports must be properly drained. The ideal procedure is to design and build the complete drainage system as an integral part of the airport development—as was done at New Orleans Airport.

And, as at New Orleans, the preferred drainage construction is *concrete pipe throughout. Concrete fully meets ALL the requirements of low first cost, structural safety, durability and maximum hydraulic capacity.*

Concrete pipe has been used to drain many of the country's leading airports. Write for literature on use of concrete pipe and reinforced concrete for your drainage or sewerage problem.

PORTLAND CEMENT ASSOCIATION, Dept. 11-29 33 W. Grand Ave., Chicago, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

VALUE

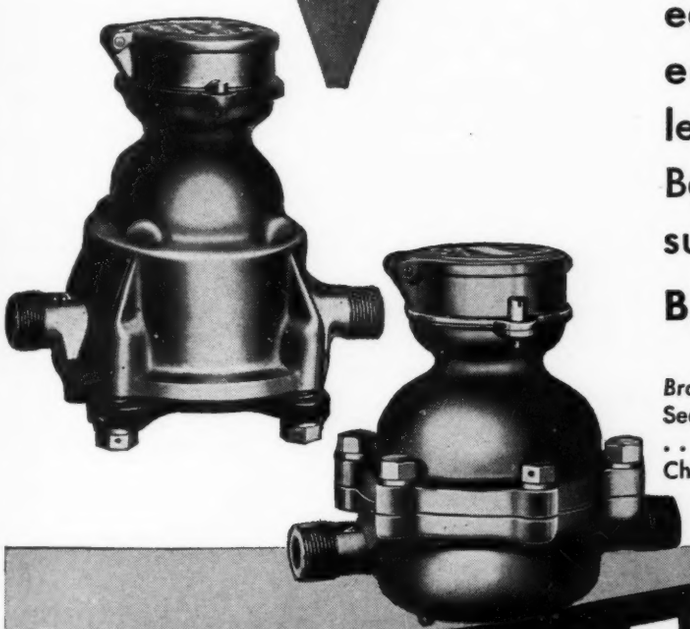
ACCURACY . . .

The Badger Meter Mfg. Company pioneered higher water meter accuracy standards.

Constant improvements in equipment have been made each year to maintain this leadership . . . In specifying Badger Meters you are assured of greater accuracy.

BADGER METER MFG. CO.
MILWAUKEE, WISCONSIN

Branch Offices: New York City . . . Tampa, Fla. . . . Seattle, Wash. . . . Savannah, Ga. . . . Kansas City, Mo. . . . Marshalltown, Iowa . . . Los Angeles, Calif. . . . Chicago, Ill. . . . Waco, Texas . . . Philadelphia, Pa.



DURABILITY
DEPENDABILITY
SENSITIVENESS
LOW COST MAINTENANCE

BADGER *Water* METERS

What'll we do?

Our water supply is polluted . . . and it connects with the city mains!

HUNDREDS of thousands of citizens were in danger. The distribution system of a great city was interconnected at one point with a private water supply . . . and the latter had become dangerously polluted!

A steel piling driven into the ground had shattered a pressure sewage main. Sewage flowed into a private water system which was cross connected to the municipal water supply. There was no sure way to determine whether any of the polluted water had reached the city mains . . . but there *was* a quick, dependable method right at hand to sanitize the supply. The municipal plant was amply prepared with Perchloron!

Perchloron, solution barrels, and a pump were immediately loaded on a water works truck and set up at a fire hydrant near the potential source of pollution. Perchloron solution was pumped into the city main, providing emergency chlorination that protected the population against danger.

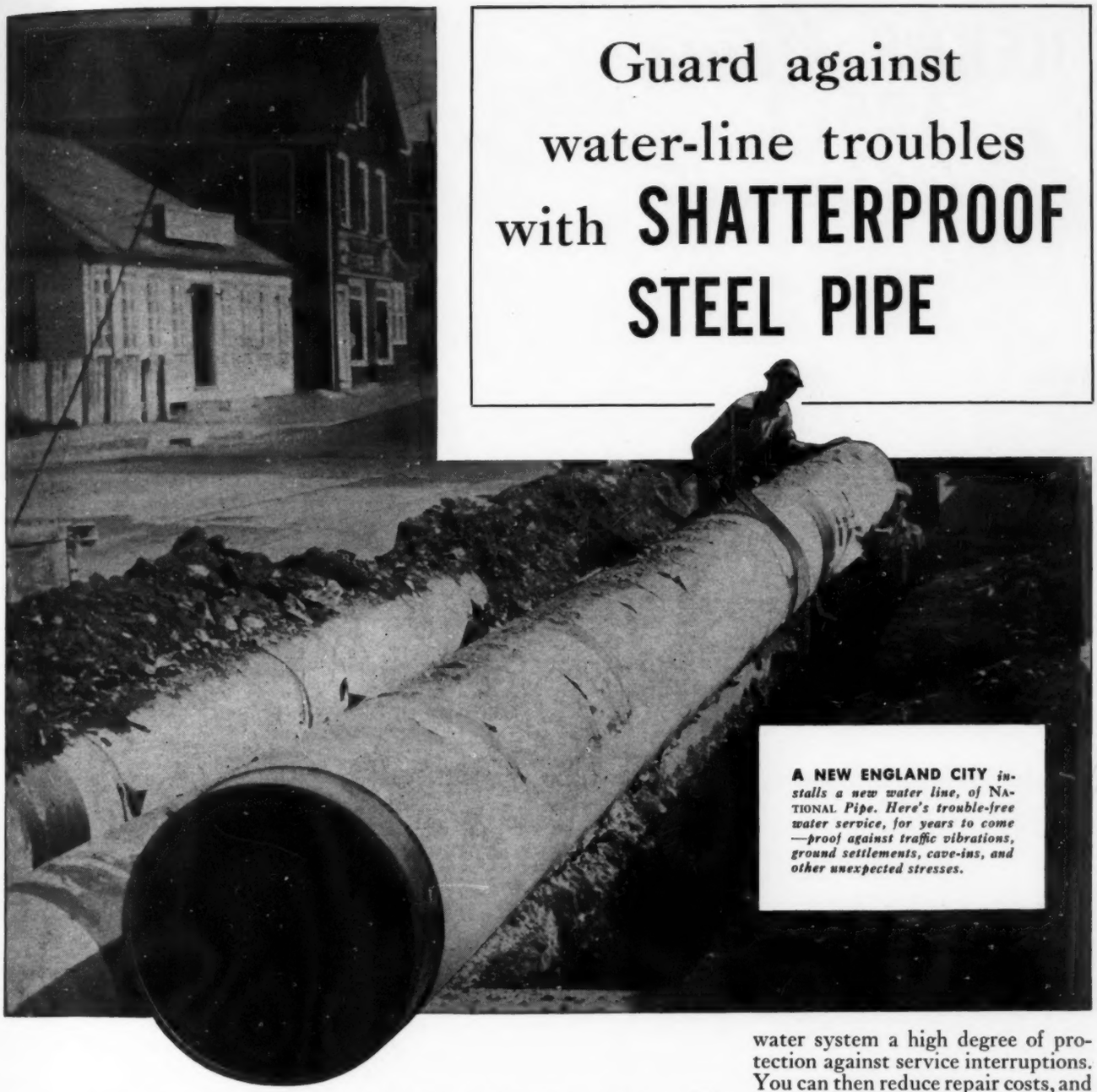
That is an instance of the way Perchloron fits in. Plants in every section of the country have found how well it pays to be prepared with Perchloron. They use it, not only for emergency chlorination, but for sanitizing new mains, for clear wells and filters, and for swimming pool sanitation.

Perchloron, a dry, free-flowing granular material, contains more than 70% available chlorine. It is stable, concentrated, uniform. Ready-to-use solutions are quickly prepared by dissolving it in tap water. Packed 9 handy-sized cans to the case, each can with Kork-N-Seal cover. Also in 75-lb. drums. Write for free booklet. Pennsylvania Salt Mfg. Co., Widener Building, Philadelphia, Pa.
New York • Chicago • St. Louis
Pittsburgh • Tacoma • Wyandotte.

Perchloron

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

Guard against water-line troubles with SHATTERPROOF STEEL PIPE



A NEW ENGLAND CITY *installs a new water line, of* NATIONAL *Pipe. Here's trouble-free water service, for years to come —proof against traffic vibrations, ground settlements, cave-ins, and other unexpected stresses.*

. . . your best protection against the "unexpected"

YOU can't always predict where or when the next washout will occur; where the ground may settle; or where street traffic or nearby construction may set up destructive vibrations. Yet these and other types of unpredictable stresses can cause serious ruptures in water lines — *unless* they are constructed of shatterproof material.

NATIONAL Steel Pipe is shatterproof pipe. It has amazing strength and resilience; you can bend it, twist it, and even flatten it, but unlike frangible materials, it will not break suddenly, or shatter. This property makes steel pipe the ideal material for mains, service lines, and laterals. By using steel for all new lines, and for replacements, you can give your water system a high degree of protection against service interruptions. You can then reduce repair costs, and save property damages.

In addition you save installation costs with NATIONAL Steel Pipe, because it comes in long lengths, requiring fewer joints, less labor, less joint material. These are only a few of the reasons why hundreds of American Cities are now using steel pipe in their water systems. Be sure and specify NATIONAL Steel Pipe for mains, service lines, and laterals. Write today for complete data.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

HERE'S *News* ABOUT *High Capacity* AERO-FILTERS!

If you want Lower Operating Costs... Greater Efficiency in Purification ...send for this book!

How can you know that you're choosing the best sewage treatment process? Follow the example of skilled consulting engineers—before you select any process or product, thoroughly investigate the Rex Aero-Filter used in over 40 plants for its low first cost, reasonable operating costs and demonstrated efficiency of purification. This book, Bulletin No. 329, gives you a resume of the Rex Aero-Filter process, is complete with flow diagrams, installation reviews, and tabular data, which will help you materially when selecting and designing the trickling filter for your plant. Address Chain Belt Company, 1610 W. Bruce St., Milwaukee, Wisconsin.

TEN REASONS WHY YOU SHOULD INVESTIGATE REX AERO-FILTERS

1. Excellent momentary distribution, no costly recirculation.
2. In single stage operation, it offers reduction of raw sewage B.O.D. equivalent to conventional trickling filters.
3. For two-stage operation, it approaches activated sludge performance at half the cost.
4. Remarkably low installation costs.
5. Low operating costs.
6. Sludge from final clarifier returnable to primary clarifier before pumping to digester.
7. All sewage settled before applied to a subsequent aero-filter—no sewage by-passed.
8. Minimized trouble from odors, freezing, ponding and filter flies.
9. All returns made direct to a head box following the primary clarifier.
10. Recirculation through filter may be used in any ratio to the raw sewage desired.

REX CHAIN BELT COMPANY of Milwaukee

SANITATION EQUIPMENT

From Chemical Feeders To Windshield Wipers

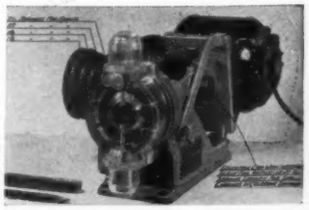
Diaphragm Pump patent interference between TRICO PRODUCTS CORP. (World's Largest Manufacturers of Windshield Wipers) and % PROPORTIONEERS, INC. % (Chemical Feeder Headquarters)

has been amicably settled. Trico Products Corp. has conceded % Proportioneers' % priority—% Proportioneers, Inc. % has licensed them as the **only** manufacturer of diaphragm type pumps as yet authorized to use % Proportioneers' % patented long-life diaphragm under U. S. Patent 2,185,784, issued Jan. 2, 1940.

To date, no manufacturer offering positive displacement chemical feed pumps to the water works and sewerage field has been licensed.

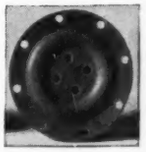
Sound fundamental design uses only the minimum number of parts necessary to get the most dependable operating satisfaction. Count the number of parts on Chlor-O-Feeder, Amm-O-Feeder, and other % Proportioneers' % "Little Red Pumps"—you will find fewer parts than on pumps complicated with "patent dodging" problems.

Patent 2,145,566 covers % Proportioneers' % improved structural features now recognized as essential in attaining accurate dependable hypo-chlorination, aqua ammoniation, and other chemical feeding at low cost.



Patent 2,185,784 covers % Proportioneers' % exclusive diaphragm with annular bead or corrugated construction assuring long lasting and accurate feeding.

Patent Pending on % Proportioneers' % "See Thru" construction.



Above—Midget Chlor-O-Feeder with See-Thru Reagent End.

Right — % Proportioneers' % Famous Long-life Diaphragm.

Pump manufacturers interested in license or information on Patents 2,185,784 or 2,145,566, or other % Proportioneers' % granted or pending patents, please address inquiries to:

JEFF CORYDON, President

% PROPORTIONEERS, INC. %

"Chemical Feeder Headquarters"

9 N. Codding St. Providence, R. I.

WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Experiences in Protecting Water Pipes from Frost"
Comes from the "land of experience"—Maine. Up until last winter there would have been little interest south of the Patomac in an article of this nature. After hearing the experiences of the Lexington, Kentucky, Water Co., as revealed in the report covering the recent meeting of the Kentucky-Tennessee Section of A.W.W.A. appearing in this issue; and, knowing what Atlanta, Ga., faced in 1940, the forthcoming article on pipe and hydrant protection against freeze-ups will be of more than sectional interest. The author—
FRED J. RENY, General Manager, Portland Water District, Portland, Me.

"Lime and Lime Slaking"
Discusses fundamental considerations in the choice and handling of lime in water and sewage treatment which should enable operators to select or specify the lime of characteristics and quality most suitable and economical for the use to which it is to be put. Particular attention is given to the matter of how most effectively feed and slake quick lime and apply the "cream of lime" suspension resulting from proper manipulation in slaking control. The author—
H. E. LORDLEY, Manager, Filtration Plant, Richmond, Va.

"Thawing Mains and Service Lines"
Comes from a plant manager of considerable experience who discusses basic considerations and outlines practical procedures in main and service line thawing by electrical methods. In brief, the contribution constitutes a "Guide in Electrical Thawing" comprising useful data, recommended procedures, and suggested precauutions to consider. The author—
FRANK C. AMSBARY, Jr., Manager, Illinois Water Service Co., Champaign, Ill.

"Sewage Sludge—Its Hidden Assets"
This caption of our own making designates an article which is to discuss the *fertility* values of sewage sludges not revealed in any test which alone reveals *fertilizer* values. In short, sewage sludge possesses "hidden assets" in the form of fertility value over and above plant food content alone. What are these values which can't be compared or sold on the bag analysis basis of the ordinary fertilizers? Aside from its humus and "soil conditioning" value, sludge seemingly contains growth promoting substances—plant vitamins—and these are the values which deserve more emphasis. The author is—
DR. WILLEM RUDOLFS, Chief, Water and Sewage Research, N. J. Expt'l Station.

"Solving the Problem of Billing for Sewage Disposal"
Constitutes an evaluation of the most satisfactory basis for sewer rental charges, the most workable rate structure, form of billing the users, method of collection, the segregation of sewerage revenue from water receipts collected by the Water Department. These and other pertinent questions are discussed and analyzed. Consideration in detail is devoted to the problems encountered in the practice of billing and collecting for sewage disposal on the basis of water consumption. Experiences met with and problems solved by the Detroit Water Department are reviewed. The trend in the direction of charging sewer rental and making collections through Water Departments is growing, and much of value as a guide to others is found in Detroit's experiences with this relatively new scheme. The author is—
HAL. F. SMITH, Ass't to the Manager, Dept. of Water Supply, Detroit, Mich.

"Improving the Hydraulic Characteristics of Mechanical Flocculation Units"
Is the recounting of experimental studies leading to the development of improved design in mechanical flocculation chambers. The result aimed at and attained was the minimum of short circuiting approaching as nearly 100 per cent of the calculated theoretical displacement as has yet been demonstrated or recorded. Out of this study came the multi-unit "Floctrol." The author, and inventor, is—
R. D. NICHOLS, The Jeffrey Mfg. Co., Columbus, Ohio

VOL. 87, NO. 11

CONTENTS

NOVEMBER, 1940

Tucson's Water Works Improvements 505
By JOHN A. CAROLLO, Consulting Engineer, Phoenix, Arizona, and PHIL J. MARTIN, JR., Superintendent of Water and Sewerage, Tucson, Arizona

Sewage Works Federation's First Convention 509
(Second Installment)

American Water Softening Plants of Especial Interest .. 520
By L. J. ALEXANDER, Operations Engineer, Southern California Water Company, Los Angeles, California

Ohio Sewage Treatment Conference 526
By W. D. SHEETS, Shift Supervisor, Sewage Treatment Works, Columbus, Ohio.

Kentucky-Tennessee Section Returns to Lexington 530

New England Water Works Association's Record Convention 537
(Second Installment)

Wisconsin Section Meets in Manitowoc 543

A Multiple Nomograph for Chlorine Demand Determinations 547
By G. E. SYMONS, Chief Chemist, and S. R. KIN, Asst. Sanitary Engineer, Buffalo Sewer Authority, Buffalo, N. Y.

Chlorine Ice Troubles 549
By DON CALDERWOOD, Engineer, Pennichuck Water Works Company, Nashua, N. H.

Editor's Comment 550

Meetings Scheduled ..... Ad. Page 72

Literature and Catalogs Received ..... Ad. Page 72

Equipment News ..... Ad. Page .79

Manufacturers' News ..... Ad. Page 83

H. P. GILLETTE, President; E. S. GILLETTE, Vice Pres. and Publisher; L. H. ENSLOW, Vice Pres. and Editor; JOHN C. BLACK, Managing Editor; Associate Editors — J. R. BAYLIS, A. M. RAWN, H. A. FABER; H. J. CONWAY, Make-Up Editor; D. G. LEDGERWOOD, Advertising Editor.

Chicago Office, L. H. Lingnor, Rep., 330 S. Wells Street. Cleveland Office, B. C. Brumm, Mg'r., 1217 St. Charles Avenue, Lakewood, Ohio. New York Office, J. M. Angell, Jr., Eastern Mg'r., 155 East 44th Street. San Francisco Office, Don Harway, Rep., 155 Montgomery Street.

Interchangeability

The Symbol of Sustained Accuracy

Trident Meter interchangeability is not confined to Trident Frost-Proof and Trident Split Case Meters. This general Neptune principle applies as well to Trident 1 1/2" and 2" Style 3 Disc Meters, which have been made with interchangeable parts for over 30 years. This feature is particularly valuable in these larger size meters, with their larger and necessarily more expensive parts. In Style 3 Meters will also be found such modern Trident improvements as the screwless register, oil-enclosed gear train, sand ring, thrust roller and thrust roller bearing plate.

Pioneers in Meter Progress

WATER WORKS & SEWERAGE

VOL. 87, NO. 11 *A Gillette Publication* NOVEMBER, 1940

TUCSON'S WATER WORKS IMPROVEMENTS

A Look Behind the Specifications

By
JOHN A. CAROLLO
Consulting Engineer,
PHOENIX, ARIZONA
and
PHIL J. MARTIN, JR.
Sup't of Water and Sewerage
TUCSON, ARIZONA

TUCSON'S P.W.A. application for a loan and grant of $226,000 to help finance a $503,000 waterworks improvement was approved late in June, 1938. Headman, Ferguson & Carollo were employed as the engineers on July 1, 1938, and the bond election of $277,000 carried August 1st. Construction was to be started by August 26, 1938. The construction starting date was met by preparing plans and specifications calling for bids and awarding the contract for about $9,500 of pipe work. Plans for the bulk of the pipe work were undertaken at the same time because the P.W.A. had also approved about $1,000,000 of paving projects that were to start in September and the water mains had to be laid ahead of such paving.

Tucson has for some time been divided into two pressure districts, because elevation differences between the east and west portions of the city resulted in an 85 pound per square inch pressure in low, and but 5 to 10 pounds in the high areas. The territory served at 85 pounds contained much forty-year-old Class A cast iron pipe. During the course of the work some of this pipe was found to be badly graphited and corroded and was replaced.

The Tucson system involved direct pumping into the mains, without benefit of elevated storage. The South Side wells were pumped into a six mile concrete gravity line delivering to a 1.5 million gallon reservoir and the high pressure pump station at 18th Street and Osborne Avenue in the southwest corner of the city. In the northeast part of the city four wells delivered water through a 24 inch steel line into another 1.5 million gallon reservoir from where it was boosted into the system.

The Project—Proposed and Realized

The city's P.W.A. application contemplated a million gallon elevated tank, a 5.0 million gallon ground reservoir at the Osborne Street location and 68,000 feet of pipe. Actually, however, two one million gallon elevated tanks, a 7.3 million gallon reservoir and 90,000 feet of main were constructed in the end. The North Side pumping plant was completely rebuilt, including deep well pumps, booster pumps, chlorination and complete metering. A gas engine standby was installed and the two pressure areas were connected with booster pumps. Also more than 100 fire hydrants were added to the system.

P.W.A. red tape, rapidly moving paving contractors and troubles inherent in a major opera-

Corrosion Within and Without
(Above) A Sample of What Arizona Desert Soil Does to Cast-Iron Pipe—Pitting and Graphitization After 40 Years Service. (Below) Old Valve Parts (According to an Archaeologist).

tion on an old distribution system, we found to be trifles when a certain bobbed haired female "Regional Planner" launched a "Blitzkrieg" and "fifth column" attack. She presumed that the Tucson Water Department worked like Topsy grew up. Her plans flew high, and she used the elevated tanks as her major targets. She objected to ugly elevated tanks. When shown the modern graceful designs she objected to their size and claimed they would spoil Tucson's skyline. During this skirmish with our "Regional Planner" the Mickelsonian phrase "Dos Tankos Grandes" was coined.

All this was exploded by publicity over the radio and in the newspapers, and discussion in the council chambers concerning the benefits of elevated storage. In the interim other engineers were brought in by the opposition, but their report only strengthened the claims of the Water Department. The Regional Planners then gave up the fight and concentrated on a through traffic route. We felt sorry for the traffic boys, but rejoiced that our two months' visitation was over, leaving a better understanding of the efficacy which a "hair shirt" has to strengthen people for the vicissitudes of life.

Specifications for Non-Corrodible Valves

Experience at Tucson had shown that an ordinary water works valve corroded rapidly, often so extensively that it was impossible to get complete shut offs. This happened in spite of periodic operation and systematic repair of valves. Four and six inch valve stems were broken with such frequency that special precautions were considered necessary. The following are excerpts from the specifications set up:

Double disc valves shall be iron body with parallel seats, bronze mounted gate valves except that the discs and expanding mechanisms shall be solid bronze.

Phosphor Bronze	Everdur Metal	Stainless Steel	Monel Metal
Cu 79.7%	Cu 94.8 to 96.0%	Fe 90.0—92%	Ni 67.0%
Sn 10.0	Si 3.0 to 4.0	Cr 8.0	Cu 30.0
Sb 9.5	Mn 1.0 to 1.2	Mn 0.4	Fe 1.4
P 0.8		C 0.12	Mn 1.0

Valve Size Inches	Minimum Stem Diameters — Outside Diam. Inches	Root Diam. Inches
4	1¼	1
6	1 5/16	1 1/16
8	1⅜	1⅛
10	1 7/16	1 3/16
12	1½	1¼
16	1 11/16	1 7/16
20	2	1¾

Valve parts, when required, were then coated with "No-Ox-Id," for protection against corrosion.

Experience with valves and skimming devices in both sewerage and water works practice indicates that stainless steel is perhaps the least resistant of the above specifications. A great deal of complaint was heard from various companies that the valve specifications were difficult to comply with; but in the end we actually bought such valves for less than Tucson had been accustomed to paying for ordinary water works valves. During the past year some of the valve companies have been advertising metals of similar compostion. Most of these specifications are of high copper content.

Selection of Pipe Materials

Treatment of water is undoubtedly helpful in minimizing interior pipe and valve corrosion but experience with metals, galvanic effects and soil attack continues to indicate the importance of non-corrodible pipe materials and of linings and coatings for corrodible materials.

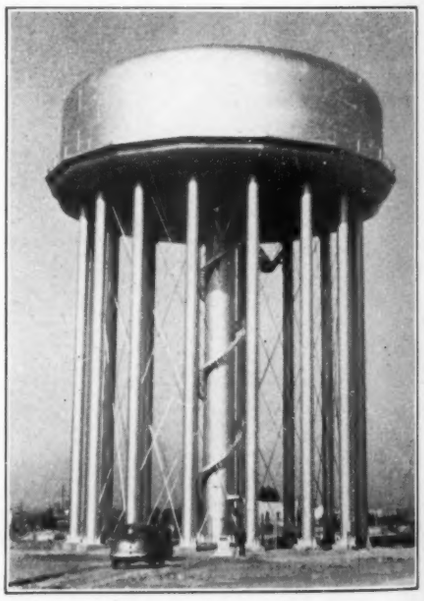
A number of Arizona towns have experienced extremely rapid deterioration of cast iron pipe from soil corrosion in certain areas. The accompanying photographs reveal the condition of some of the pipe and valve parts replaced in Tucson.

The favorable price differential existing six or seven years ago between cast iron and "Transite" pipe led a number of Arizona water works operators to install trial lengths of this cement-asbestos pipe in places where difficulties had been experienced.

For Tucson, we specified cement-lined cast-iron, "Transite," and ¼ inch wall steel [coal tar lined and coated, and asbestos wrapped] where suitable. Keen competition developed and its effect is seen in the fact that 6 inch pipe cost from 60 to 84 cents per foot, as against 92 to 98 cents per foot for large orders placed in 1936 and 1937.

All pipe going into the Tucson project was tested to 200 pounds per square inch in place before backfilling, maintained in most cases for one hour. All visible leaks were repaired. This test pressure emphasized the need of backing all bends, for the end thrust on 20 inch pipe under a pressure of 200 pounds is over 64,000 pounds. The backing was accomplished with concrete, so designed to reduce the soil pressure to less than 2,000 pounds per square foot, ignoring soil friction on pipe. [The loadings on the elevated tank

One of Tucson's "Dos Tankos Grandes"
(Successful Bidder—Chicago Bridge and Iron Co.)



On the Other Side of Town
(This tank fabricated by the Allison Steel Mfg. Co.)

foundations were limited to 3,000 and 4,000 pounds per square foot.]

Jointing Experiences

Joints for cast iron pipe were made with lead, cement or bolted rubber; for transite. lead or rubber rings; for steel, Dresser couplings were used exclusively.

Unit 1, for $9,500, allowed the use of cast-iron pipes with precaulked lead and redwood joints. Difficulty with this type of joint had been experienced elsewhere in Arizona, but the Tucson Water Department, by the use of extreme care, had enjoyed some measure of success with it, and four city blocks of 12 inch precaulked cast iron pipe were laid. On this limited run of pipe thirteen joint failures occurred during the year, notwithstanding the fact that the contractor had the benefit of the manufacturer's supervision on the job. Several explanations have been advanced for the failures, but what seems to be the most plausible explanation is that for 12 inch pipe or larger excessively heavy blows must be struck to caulk the cold lead. This being true, the joint is often not caulked sufficiently, or else the red-wood backing is injured. The cost of repairs to the contractor ($256) was reimbursed by the pipe manufacturer. The Water Department has also experienced some difficulty with this type of joint in 4 inch, 6 inch and 8 inch pipe laid with its own crews.

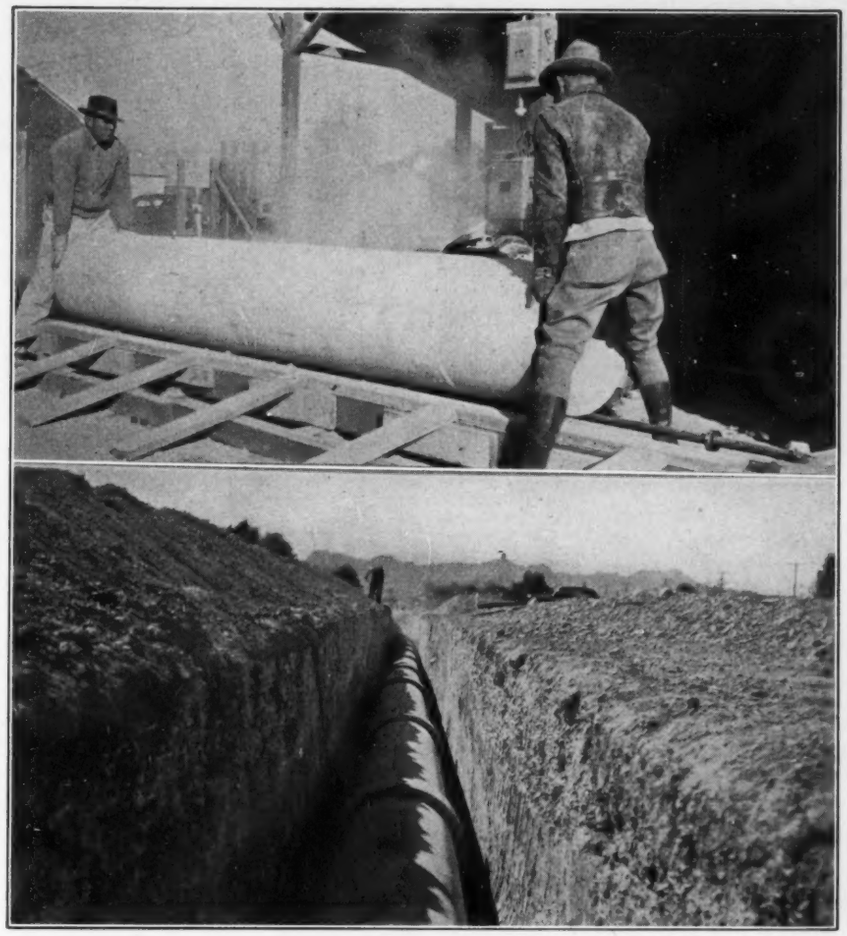
Practically 90 per cent of the cast iron joints were of cement and only one leak occurred in the cement caulked joints. This single leak occurred on test and was repaired. Lead or bolted joints were used in conjunction with the cement, for flexibility.

Costs of improvements are divided roughly as follows:

Mains, valves and hydrants	$236,881.66
Reservoir	54,461.83
Chlorinator, pump and booster stations	44,388.38
Elevated tanks (2), 1 m.g. each	140,154.75
Pump bowls, meters, etc.	2,220.14
Engineering and legal	26,185.62
Total	$504,292.38

The following tabulation of low bids, we believe, indicates the value of careful preparation of complete, detailed plans and specifications. Four or more bids were received on all calls:

16" and 20" Pipe to East Side Tank (Unit 1)	
Steel pipe alternate	$40,527.77
Transite alternate	41,731.80
6" to 12" Pipe (Unit 2)	
Cast iron alternate	40,751.50
Transite alternate	41,881.05
6" to 20" Pipe (Unit 3)	
Transite alternate	123,380.93
Cast iron alternate	129,907.50
Cast iron and steel alternate	130,022.29
7.33 M.G. Covered Reservoir (Unit 4)	
Low bid	53,999.35
Second low bid	56,900.35
Randolph Park Tank—1 M.G. Capacity (Feb. 16, 1939)	
Chicago Bridge & Iron	68,805.00
Allison Steel Mfg. Co.	69,496.00
Pittsburgh Des Moines	70,175.00
North Side Elevated Tank—1 M.G. Capacity (1st call Jan. 20, 1939)	
Vinson & Pringle	84,600.00
Pittsburgh Des Moines	84,150.00
Chicago Bridge & Iron	91,660.00
North Side Tank—1 M.G. Capacity (2nd call, Feb. 25, 1939)	
Allison Steel Mfg. Co.	71,349.75
Pittsburgh Des Moines	74,669.00
Chicago Bridge & Iron	74,735.00



"Transite"
(Above) Sawing a length to fit.
(Below)—A line ready for backfill.

Bidding on the elevated tanks was especially interesting. Until January 20, 1939, it appeared that only two firms would bid. Because of a freight reduction clause in the specifications, which caused some confusion, new bids were called for. In the final outcome a revision of bids saved the city of Tucson at least $20,000, without sacrificing either utility or beauty of structure. This we believe the pictures of the two tanks substantiate.

A Couple of Headaches

The coating of 11,000 feet of 16 and 20 inch steel pipe in the field proved to be the only unit of work in which contractors, engineers and material men failed to cooperate fully. The concern coating the pipe for the contractor refused to correct the methods of application. The result was evident in the coating and the job was condemned. The pipe coating concern was required to clean the pipe thoroughly and place a new coating which would meet the specifications.

The reservoir was our biggest headache. "Thermoplastic Rubber" was specified for joints in the gunite floor. The proportion of rubber to coal tar was important in determining whether the material would flow under pressure; about 350 degrees was found to be the maximum safe heating temperature; pouring methods to exclude steam or gas bubbles in the finished work were devised; four trials were required to get satisfactory results. While

this work was going on rebound or poor gunite was found at the joints in a number of places. The contractor placed another gunite slab at his own expense. The leakage, before repairs, was measured at about 1,100 gallons per day, an evaporation gage combined with a hook gage being employed to determine the loss. One month after the repairs, and the successful use of Bentonite, the leakage was measured over a three day period and was only about 100 gallons per day at that time. However, it continued to decrease, and at present no loss can be detected and, therefore, what leakage there may be is certainly negligible for a 7,300,000 gallon reservoir.

Out on the Job
From left—Phil. J. Martin, Jr., Supt. of Water and Sewerage; L. R. Burch, Engr. and Asst. Supt.; Contractor Johnson; and John A. Carollo of Headman, Ferguson and Carollo, Engineers.

Some Economic Results

The water works project was sold to the public by the Water Department in talks over the radio and in newspaper articles. Arguments were not alone confined to need because of low and high pressures, poor service and lack of fire protection; but, the improvements were argued as a money saving undertaking. The people were told that savings could be made in power, labor and insurance costs. At the time the last item was estimated at only $13,000 per year. Recently, however, insurance rates were reduced, solely because of the water works improvements, by about $30,000 per year. The greater reductions were realized because an additional elevated tank, more large piping and increased ground storage were installed in addition to the bettermonts originally planned.

The following tabulations indicates the saving represented by power costs alone:

Period	Gallons Water Pumped	Cost of Power — Total	Cost of Power — Per 1,000 Gal.
Nov. to May, 1938-39	710,480,000	$21,515.48	$0.0303
Nov. to May, 1939-40	982,583,000	23,550.90	0.0239
Difference			$0.0064

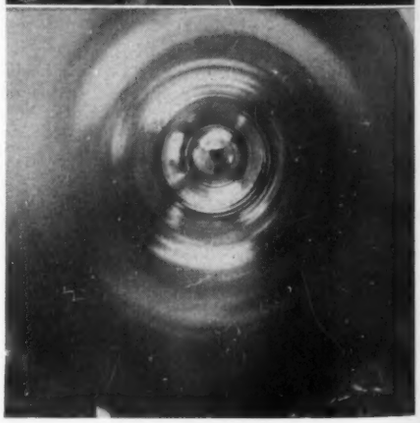
Based on the 1938-39 cost per thousand gallons, it would have cost $29,772.26 to pump the 982,583,000 gallons of water. A saving of $6,221-.36 is therefore indicated for this period alone, and a saving of $12,000 is a modest estimate of the saving for the full year of 1940. This amount will increase as water consumption increases.

The saving in cost of power per 1,000 gallons pumped amounts to 21 per cent. The explanation of this is found in the combined effect of more efficient pumps, and a lower pumping head, due to larger pipes of higher coefficients, the elevated storage effects, and elimination of the reduced power demand charge on the North Side as the result of providing elevated storage.

As a matter of interest maximum pumping head for one portion of town was reduced from 85 pounds to 75 pounds and the service pressures for the other portions were raised from a 5 pound minimum to a 35 pound minimum. Then, the installation of complete metering, automatic chlorination and remote control of pump operations automatically has made possible a saving in labor amounting to $3,000 per year.

The entire savings that are a direct result of the improvement will total at least $500,000 in ten years, representing practically the total cost of the project. In addition, the Water Department is now in position to greatly expand its business. The higher sustained pressures may in itself be responsible for an increased consumer use.

The authors wish to express their appreciation of the sound judgment and ready assistance given by the late City Manager of Tucson, R. E. Butler. We thank members of the Water Department, assistant engineers of Headman, Ferguson & Carollo, Robert W. Hunt Co., Arizona Concrete Co., Williams & Van Valkenburg, Vinson and Pringle, Martin Constr. Co., Tanner Constr. Co., Chicago, Bridge & Iron Co., and Allison Steel Mfg Co. for their fine work and cooperation in making this project a sucess.



"Steel and Tar"
(Above) The electric "Valley" detector.
(Below) A pretty "slick" job of lining —not a "valley."

SEWAGE WORKS FEDERATION'S FIRST CONVENTION

(Second Installment)

THE initial installment of this report covering the First National Convention of the Federation of Sewage Works Associations, held in Chicago October 3rd, 4th and 5th and attended by better than 600 members and guests from all sections of the country, appeared in our October issue. The place and time of the Second Annual Federation Convention in 1941 is to be decided by the Board of Control at its Annual Meeting in New York City in January. It will be held in the Fall—most likely in October.

A Digest of Papers and Discussion

(Continued)

"New Operating Results in the Chemical Treatment of Sewage" by Dr. Willem Rudolfs, Chief, Dept. of Water and Sewage Research, N. J. Experimental Sta., New Brunswick, N. J.

Terming his paper "Chemical Treatment News Notes," Dr. Rudolfs stated that a survey of results from, and costs of, chemical treatment indicated that chemical precipitation effluents, without the aid of filtration, could be expected to contain about 50 p.p.m. suspended solids at moderate cost for chemicals. At higher costs a clearer effluent of 20 p.p.m. could be secured.

W. B. Walraven, Chief Engr., Sanitary Distr., Springfield, Ill.

Paul Molitor, Jr., Supt. Sewerage, Morristown, N. J.

Ralph E. Fuhrman, Asst. Supt., Sewage Treatment Wks., Washington, D. C.

Based on average results from 12 small to medium plants, treating from 0.4 to 4.5 m.g.d., such results had been secured with ferric-chloride and lime at a minimum cost of $7.80 and average of $9.80 per m.g. for chemicals involved. Whereas this might seem high for continuous treatment, the fact that chemical treatment is generally a seasonal operation the average cost may be half or less for the full time average and attractive, thereby, for filling the intended role of seasonal betterment at minimum overall costs.

In comparing the three iron coagulants—ferric chloride, chlorinated copperas and ferric sulphate —all produced approximately the same results at the same cost. In considering the value of lime as a flocculating aid, Dr. Rudolfs pointed out that in many sewages, especially those of high alkalinity and strongly buffered with laundry or industrial wastes, the lime produced a floc shrinking effect of considerable benefit. Always more difficult to flocculate was the so-called "Blue Monday Sewage" containing much laundry water.

K. L. Mick, Chief Chemist, Minn.-St. Paul San. District

Don E. Bloodgood, Indianapolis, (New Vice-Chmn. C. S. S. W. A.)

The New Brunswick laboratory has been making a study of chemicals and their relative merits. Dr. Rudolfs reported on these investigations as follows :

Silicate-Alum Treatment: Presented difficulties in proper preparation of the activated silica jel by sulphuric acid acidification of silicate of soda. Of questionable merit for the smaller plants.

"Di-Ferric Tetra Chloride: A composite of ferric chloride and filter alum. Compared with alum alone produces a better settling floc at less cost per pound of B.O.D. removed. Especially beneficial on "Blue Mondays" during flow of laundry waters.

Filter Alum: Sludge therefrom not as satisfactory for vacuum filtration as iron sludge. Slower floc to settle. Lime improves floc behavior.

"Ferric Jell": A non-patented preparation of ferric chloride and gelatine. This interesting coagulant produces surprising results, amongst which is the rapidly produced ball-like floc requiring 40% less ferric chloride over a wide pH range of 4.5 to 8.5, with 4.5 to 6.0 the optimum range. In treating industrial wastes seems to have especial merit. After 15 minute mix if anything the floc settles *too* rapidly. The sludge is easily dewatered. This ferric jell is far less corrosive than ferric chloride and costs less to use.

Dr. Rudolfs said that as an aid to subsequent biological treatment chemical precipitation had not expanded as should be expected, and the general tendency was to underestimate the value of chemical treatment which has lost none of its merits as a useful "tool" and aid in operation.

In reply to questions, Dr. Rudolfs said that rapid mixing with diffused air and mechanical mix had proved about equal on domestic sewages. For the slow mix stage (flocculation) mechanical mix was to be preferred.

E. Hurwitz, Prin. Sanitary Chemist, Chicago Sanitary District, reporting on chemical precipitation studies by the District, stated that

W. E. Collings, Supt., Sewage Treatment Wks., Collingswood, N. J.

Walter E. Sperry, Supt., Sanitary Distr., Aurora, Ill.

John C. Mackin, Supt., Sewage Treatment Wks., Madison, Wisc.

the combination of copperas and activated silicate of soda had given the highest B.O.D. removals (73.5% avg.), with ferric chloride next (67.8%) and alum somewhat less (65.5%). The silicate-copperas treatment involved dosages as follows:

Copperas .....154#/m.g.
Silicate of Soda.....115#/m.g.
66° Sulphuric Acid.. 15#/m.g.

(1) *Paul Fox, State San. Engr., Santa Fe, N. M., and Dana E. Hepner, Secy.-Treas., Rocky Mtn. Assn.;* (2) *R. D. Nichols, Jeffrey Mfg. Co., Columbus, O., and C. K. Calvert, Indianapolis Water Co.;* (3) *Bob Steindorf of Chain Belt Co. and Geo. J. Schroepfer, General Convention Chairman;* (4) *C. T. Wilson, Supt. of Sewage Plants, Waterloo, Ia., and Jim Montgomery, Lakeside Engineering Corp., Chicago;* (5) *R. D. Wood Co.'s Lee Williamson, Engr., and Charlie Becker, Sales Mgr.*

Comparing costs—

Copperas-Silicate ....$2.27/m.g.
Ferric Chloride ..... 3.24/m.g.
Chlorinated Copperas 3.27/m.g.

Some work had also been done looking toward utilization of spent iron pickling liquor from the Chicago area.

"The Effects of Variation of Flow and Composition of Sewages on Treatment" by A. M. Rawn, Chief Engineer, Los Angeles Sanitation District, Los Angeles, Calif.

Mr. Rawn was prevented from attending the convention due to pressure of work following the death of former Chief Engineer A. K. Warren. His paper, read by H. W. Jewell of Los Angeles, reviewed some of the causes of operating griefs from variations in sewage quality and flow and listed some remedial or alleviating measures. He cited the case of Sacramento, California, where seasonally the wastes from canning plants raised the domestic population load of 100,000 to 400,000 equivalent during seven months of canning; also where flow variations covered a 4.9 to 18 m.g.d. range. At Palo Alto the separate digestion plant suffered the upsetting load of canning wastes responsible for 8 ft. of scum in the digester composed mostly of fruit skins. At times, even the clarifiers contained 4 ft. of such scum. The remedial measure for the clarifiers seems to be pre-chlorination to stop gas generation and solids flotation. Mr. Rawn, in pointing to the great shock absorber as being the primary tanks, used the new San Francisco plant as an illustration. With flow variations of 2.0 to 11.5 m.g.d. and suspended solids input of 19 to 700 lbs./hr. the primary effluent there consistently contained from 20 to 40 lbs./hr. as the extremes.

Concerning corrective measures for relief, Mr. Rawn cited preflocculation, with or without chemicals, as an effective operation and one gaining favor. Considering the value of the scheme the expense is small. As to effluent straining, the expense in conjunction with primary settling alone requires more evidence of justification, than has been forthcoming. On the other hand, with biological or chemical treatment effluent straining possesses a distinct value—particularly where floc settleability is impaired temporarily, or where operating or design economy may be extended. Mr. Rawn cited the Denver, Colo., plant as an example of the effectiveness of mechanical flocculation and straining filters, with additional B.O.D. reduction and disinfection secured by chlorination.

In citing Los Angeles County experiences with sewage quality, and the profound effects of stale and septicized sewage on the County's activated sludge plant, Mr. Rawn reviewed experiences with partial chlorination up-sewer as a corrective measure to retard bio-activity responsible for conversion of settleable solids into non-settleable and partially decomposed solids, plus sulphides and other resultant by-products of septic action, so deleterious to the activated sludge process. Under such conditions of sewage degradation the county's treatment works had been able to cope with but 25% of design capacity, whereas the up-line chlorination process had yielded handsome returns in making it possible for the plant to handle 100% of design loading.

In respect to greases and spontaneous oxygen demand in sewages "Aero-Chlorination" was another interesting development in the way of "cracking-down" on incoming sewage, and deserved attention as a worthy "tool" in raising or maintaining even-keel plant performance. In summation Mr. Rawn said that grease removal, pre-flocculation, and partial chlorination comprised the simplest methods to be considered in alleviating shock and upset to biological processes such as are created by seasonal disturbances and industrial loadings exceeding plant assimilating capacities. While operators could not be charged with plant or sewer design deficiencies they should make a sincere effort to take up the slack by developing alleviating measures or putting to use already known processes possessing promise.

Robert A. Allton, Supt. Treatment Works, Columbus, Ohio, in discussing the critical effects of variations in solids loadings on sludge handling facilities pointed out that at Columbus peak days yielded five times the average solids loading for any 10 day period. Without adequate reserve capacity for sludge storage vacuum dewatering and incineration would have necessitated 500% reserve capacity of sludge disposal facilities.

C. R. Velzy, Supt. Treatment Works, Buffalo, N. Y., reported the same magnitude of solids variation at the Buffalo plant (100,000 lbs. to 500,000 lbs. daily) in which the fortunately ample storage capacity in the digestion units had proved the wisdom of the designers, Greeley and Hansen of Chicago.

K. L. Mick, Chief Chemist, Minneapolis-St. Paul Sanitary Distr., reported day to day variations of 100 to 500 tons of dry solids removed by the Twin-Cities' plant. Storage tanks (not digesters) providing only two to four days storage had proved adequate as units to smooth out this variation and keep incineration on an economical even-keel.

Chas. C. Agar, Sr. San. Engr., N. Y. State Dept. of Health, reported that in New York State a number of small sewage plants suffered severe seasonal overloading from canning plants. Pronounced alleviation of scum and sludge problems, and acid digestion, had been secured by requiring that such wastes be fine screened by canners using the sewers. Incorporated in recent small plant design, where seasonal overloading seems a likelihood provisions for chemical precipitation in the first stage are being required; likewise, the ability to recirculate effluent from trickling filters. Either or both appear to constitute impor-

(1) *Robt. C. Wilson, Aluminum Co. of America, Pittsburgh;* (2) *Floyd G. Browne, Supt. Sewage Treatment and Consultant, Marion, Ohio;* (3) *Chas. C. Hommon, Supt. Sewage Treatment and Consultant, Canton, Ohio;* (4) *Wm. E. Ross, Supt. Sewage Treatment, Richmond, Ind.;* (5) *R. K. Lewis, Chief Chemist, Sewage Treatment Wks., Indianapolis;* (6) *Sam L. Tolman, Mgr., Sanitary Sales, Jeffrey Mfg. Co., Columbus, Ohio.*

tant considerations in coping with overloading. The Department policy of requiring liberal excess plant capacity before approving plans for small plants had proved a wise one, said Mr. Agar.

Industrial Waste Treatment

"Recent Trade Waste Disposal Methods" by E. E. Eldridge, Research Associate, Engineering Exptl. Sta., Michigan State College, East Lansing.

Commenting that industrial waste treatment was still in the pioneering stage and still experimental to a large degree, Mr. Eldridge said that failures of large scale plants designed on the basis of pilot scale plant studies had been due to no failure of process, but rather to lack of understanding of the process or appreciation of the need for good supervision. While flexibility of process and plant was highly desirable, a fair degree of technical attention should be set down as an essential to success. It appeared axiomatic that the more operating attention required, the more given. Mr. Eldridge then reviewed progress and recent developments at the newer waste treatment plants of a few important industries.

Paper and Pulp: In paper and pulp waste curtailment the matter of recovery of usable materials and reduction of new water use through affluent return has constituted a trend. In one Michigan mill 9 tons daily of re-usable fiber, etc., is being recovered by chemical precipitation. Because of production of two main products of diverse character actually two recovery plants are operated by the Monroe Paper Products Company requiring only 1000 lbs. of alum daily, 50 minute flocculation, and settling periods of 2.2 hours.

Beet Sugar: In a Michigan beet sugar factory, producing 5 to 6 m.g.d. of waste, chemical precipitation is reducing a B.O.D. value of 919 to 358, permitting re-use of a portion of the effluent formerly considered impracticable. The equipment involves rotary fine screens (6 cu. yds. of screenings per m.g.); grit separation units (6.5 cu. yds. grit per m.g.); coagulation by mixing the various wastes in effective proportion and 20 minute flocculation with air; and 80 minutes of sedimentation. About 36,000 gallons of sludge (contains 15.5% solids, does not digest) is removed daily to a lagoon. Total dry solids removed daily is 32 tons which will later be dewatered on vacuum filters and returned to the land. Net results—solids removal 91.4% and B.O.D. removal 61.2%. Trend is to greater re-use of the clarified water in beet handling and washing.

Milk Wastes: In treating milk plant wastes the standard trickling filter has done a good job, but bids fair to be superseded by the high rate bio-filter requiring much less area and subject to effluent recirculation for handling higher loadings when required. Comparing the standard and the high rate filter the former handles 1 to 2 m.g./acre/day, while the bio-filter at 10 times this rate permits loadings of 1 pound of B.O.D. for each 30 cu. ft. of bed, as against 80 cu. ft. or more required in the standard filter. A concrete case was cited in which a standard filter markedly overloaded with milk wastes and producing only a 58.5% reduction of B.O.D. was converted to a high rate unit by recirculation of effluent at the rate of 20 m.g./acre/day. The high rate operation gave a performance of 90.6% B.O.D. reduction and final effluent of only 46 p.p.m. B.O.D. Of primary interest is the fact that existing standard filters can be readily converted to high-rate recirculation units.

The Guggenheim Process: Is a combination of assisting chemical precipitation and bioflocculation by air blowing. It has been applied to milk products and cannery wastes with considerable success. Biological action enters into the process to a rather marked degree, the ferric chloride and/or lime added forming the nucleus and weighting agency of the voluminous floc of bio-precipitation produced by a flora different from that of activated sludge.

Mr. Eldridge pointed out amongst other advantages the absence of bulking with sudden loadings increase or high carbohydrate input; higher efficiency than chemical precipitation, or for activated sludge with a like aeration period; is adaptable to very strong wastes of B.O.D. values up to 3000 p.p.m.

As an example, Mr. Eldridge cited a cheese plant waste of 3400 B.O.D. which treated by the Guggenheim Process netted a 96.3% B.O.D. reduction at reasonable costs. Further, recirculation of the effluent proved capable of producing a final product with B.O.D. values of only 25 to 50 p.p.m. from a real "problem-waste."

Pre-Fabricated Units: Mr. Eldridge, in citing the desire of holding plant costs to a minimum, referred to the availability of prefabricated steel units (tanks) now available for industrial waste treatment at attractive costs for the units and their installation. Especially for small plants, these so-called "package" units (offered by Lancaster Iron Works, Inc.), have an appeal to the management of industrial plants, the complete installation

(1) *Don E. Bloodgood, Mgr., Sewage Treatment Works, Indianapolis (New Vice-Pres. of C. S. S. W. A.) and His Predecessor at Indianapolis, M. W. Tatlock, Now Supt., Treatment Wks., at Dayton, Ohio. When "Tat." Started Into Selling Dried Sludge in a Big Way at Dayton, He Once Actually Imported Some of Indianapolis' Sludge to Fill Contracts;* (2) *Known in Wisconsin as "The Three Musketeers," These Buddies Are All Neighbor Treatment Works "Supers."—R. W. Frazier (Oshkosh); C. C. Baetz (Appleton); C. A. Wahlstrom (La Crosse).* (3) *L. L. Hedgepeth, Mgr., Technical Service, Penna. Salt Mfg. Co., Philadelphia, and Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York. (Another Case of "Birds of a Feather, etc.").*

costing about half as much as concrete construction for the same size plant and capable of rapid installation.

L. F. Warrick, State Sanitary Engineer, Madison, Wisc., well known for pioneering work in industrial waste treatment, said that waste treatment in Wisconsin was being given primary consideration and continuously studied for improvements and new methods. The Wisconsin policy was to give careful consideration of balance between the technical and the economic factors. With the aid of moving pictures he reviewed the work and progress made in several phases of treatment at field testing stations operated by the State Dept. of Health in cooperation with industry.

Amongst the findings was the effectiveness of Zinc Chloride with lime as a coagulant, this chemical being available at 3½ cents per lb. on the anhydrous basis ($ZnCl_2$) obtainable as a 50% solution. For the majority of plants treating canning wastes the "step method" of precipitation had proved the most practical along with the fill and draw scheme of clarification by operating the tanks in rotation. The "step method" of coagulation involves adding coagulants in increments to the agitated full batch of waste, eventually reaching the floc break-point. Thus, the most rapid and effective clarification is realized at minimum chemical requirements and costs.

In Wisconsin 50 chemical precipitation plants are now in operation producing 54 to 75% B.O.D. removals, some effluents being chlorinated to secure retarded biological action and additional B.O.D. reductions. In conjunction with municipal plants studies of pre-treatment of industrial wastes had revealed the value of chemical precipitation at lower cost per unit B.O.D. reduction than biological methods, pointing to the possibilities and value of combination plants in many cases. One such arrangement was represented by the plant of Cedarburg, Wisc., combining chemical pre-treatment and trickling filters followed by slow sand filters. This scheme effects an overall B.O.D. reduction of 96% dependably and economically for a stream affording little or no dilution.

Chemical precipitation had netted a 54% reduction in B.O.D. of beet wastes and sand filters an added 15%; and craft pulp wastes, when lime preciptated, produces a sludge sought after by farmers for fertility and acid correction value. Sulphite

Paul W. Richards, Ass't Supt. Sewage Treatment Wks., Indianapolis.

Rolf Eliassen, Prof. San. Eng., New York University, New York.

C. C. Ruchoft, Prin. Chemist, U.S.P.H.S., Cincinnati.

pulp wastes, which contain about one-half of the wood from which the pulp is made, when treated by the Howard Process returns useful calcium sulphite and lignous fuel bricks having a heat value of 8000 B.T.U. The treatment effects a 50% reduction in oxygen demand and fits into the Wisconsin picture of maximum purification within bounds of economic reason and practicability, with further improvement anticipated with general progress in pollution abatement.

Edwin C. Hurd, Cons. Engineer, Indianapolis.

Hyland P. Dodge, Supt., Sewage Treatment Wks., Ann Arbor, Mich.

Chester A. Smith, Cons. Engr., Kansas City.

Sludge Conditioning and Filtration

"Progress in Sludge Conditioning for Dewatering"—by F. Woodberry Jones, Havens & Emerson Engrs., Cleveland, Ohio.

Mr. Jones, in selecting a "text" chose "The Three Cs. of Conditioning" of sludges—namely, its composition, concentration, and chemical demand. After 5 years of progress every sludge seemingly is to a degree a problem in itself and definite conclusions were difficult to reach after a study of various data available. One thing seemed certain—namely, that vacuum filtration practice had not yet become stabilized, much less standardized in so far as dosages of chemicals employed, method of mixing, and subsequent handling are concerned.

In regards the value of partial digestion to reduce costs and increase practical attainments is concerned, the practice was of doubtful merit. To even up solids flow through the sludge handling units nothing in excess of 5 day sludge storage justified to maintain even-keel operation of filters and incinerators.

In conditioning, Ferric Chloride remained supreme. Where lime is being employed 3% CaO to the sludge is equivalent to 1% $FeCl_3$ in cost, and the economy of various combinations justified study for each condition. Ordinarily the iron salt is added first and lime next, but some prefer the reverse. Ferric Chloride solution containing 1 lb. $FeCl_3$ to the gallon proves a very handy strength to handle, for the control of dosage, and to make computations from. Mr. Jones suggested "Sludge Dewatering Practice" as worthy of the earliest committee job of a going Sewage Works Federation of national scope.

Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., following Mr. Jones as discussor seemed to qualify for the job of chairman of the committee suggested. Mr. Faber presented the results of a rather comprehensive survey by The Chlorine Institute (still underway) to determine prevailing practices and the good and the bad in modern sludge dewatering. In this instance Mr. Faber confined his discussion to chemicals, their handling and control. Questionnaires to 98 plants using vacuum filters had brought 61 replies which made interesting study and revealed the following facts:

(1) Of 46 plants now employing chemicals—85% used $FeCl_3$. (2 used chlorinated copperas; 2 ferric sulphate; 1 alum).

(2) *Types of sludges*—of the plants dewatering mechanically, 18 provide primary treatment, 10 activated sludge, 8 chemical precipitation, 2 the Guggenheim Process.

(Average solids ran from 9.3% on primary crude, 4.7% on activiated primary; 6.3% chemical pptn., 5.6% Guggenheim.

(3) *Condition of sludges treated* —17 undigested, 16 digested, 5 digested and elutriated.

(7 plants employed sludge concentration prior to conditioning.)

(4) Chemicals employed and pH attained—15 digestion plants employed lime plus ferric chloride; 5 elutriation plants had discontinued lime if ever used. On undigested sludges 3 plants used ferric chloride

(1) *A. J. Mahr, Johns-Manville Co., New York;* (2) *Walter Ashdown, Supt. Sewerage, Chicago Heights, Ill.;* (3) *E. D. Fry, Supt. Sewage Treatment, Greeneville, S. C.;* (4) *Geo. E. Flower, Supt., Southerly Works, Cleveland, Ohio;* (5) *L. H. Chamberlain, Mgr., Water and Sewage Sales, Crane Co., Chicago;* (6) *J. M. Holderby, Supt., Treatment Wks., Neenah, Wis.;* (7) *W. F. Tempest, Engr., Portland Cement Assn., Chicago;* (8) *Roy Metz., Supt. Water and Sewerage, Carthage, Ill.;* (9) *C. Schwarzler, Mgr., Water and Sewage Sales, The Foxboro Co., Foxboro, Mass.*

alone and 14 also employed lime as an aid. In regards pH value; all plants using lime ran high pH values, whereas the 9 using ferric chloride only ran pH well below 7.

(5) *Solids and filter yields* revealed average sludge concentrations varying from 4.7% solids on crude to 8.5% on digested and 7.9% on elutriated digested. Yield of filter cake from crude showed a maximum of 15.5 lbs./sq. ft./hr. and 5.2 lbs. avg.; for digested, a maximum of 14.8 lbs. and 8.5 lbs. avg.

(6) *Filter cloth history* gave life of cloths at high pH (lime use) of 100 hrs. minimum to 500 hrs. average; at low pH, 200 hr. minimum to 4000 max., and 1900 hrs. avg. On high pH 20 plants used cotton cloths and 3 woolen; on low pH 4 used wool and 1 cotton.

(7) *Form of ferric chloride used* —14 plants employed liquid; 6 the lump (crystal); 18 the anhydrous powder.

Although a lack of correlation is apparent in the analysis of data reported, Mr. Faber was not willing to agree with Mr. Jones' statement that every sludge is a problem in itself.

C. E. Keefer, Engineer in Charge of Sewage Treatment, Baltimore, Md., contributed a prepared discussion presented in his absence by A. L. Genter, inventor of the elutriation process which was developed at the Baltimore plant. Mr. Keefer reported Baltimore experiences with chlorinated copperas, such being the double salt of ferric chloride and ferric sulphate produced by chlorinating ferrous sulphate to secure the following reaction—

$$Fe\,SO_4 + Cl = Fe\,SO_4\,Cl.$$

He stated that in comparison 1 pound of ferric chloride had proved equivalent to 1.5 lbs. of the less expensive chlorinated copperas, with the net result that the latter proved the more economical conditioner since Baltimore had a very cheap copperas supply nearby. The preparation consists of dissolving 5000 lbs. of copperas in 3600 gals. of water in the chlorinating tank (20% solution) and while recirculating with a "Duriron" centrifugal pump the solution is chlorinated to completely oxidize all of the ferrous iron. Chlorine purchased in one ton containers is admitted as gas to the pump suction line at rate of 150 lbs. per hour. 1939 costs of production averaged $26.67 per ton of $Fe\,SO_4\,Cl$ (anhydrous) produced, but because of high maintenance and revamping costs in the year of learning how *not* to chlorinate copperas, costs in 1940 would be lower. Maintenance and operation costs were actually in excess of the cost of the copperas in 1939.

For elutriated digested sludge at Baltimore 3.8% $Fe\,SO_4\,Cl$ (anhydrous) had produced 5.43 lbs. of filter cake per hour per square foot of filter area—the cake averaging 73% moisture. It has been learned in Baltimore that lime was not needed and that air mix was inferior to a flash mix followed by a gentle mechanical stirring, and not too much of the latter.

"Mechanical Equipment in Sewage Treatment" by Lloyd M. Johnson, M.E., Maint. and Operations Engr., Sanitary District of Chicago.

Modern mechanical sewage treatment plants, said Mr. Johnson, had come to be either a paradise or a night-mare to the Mechanical Engineer. On the whole, added design costs in mechanizing Chicago plants had proved well justified in improved operation, and particularly in the economy in labor costs.

In commenting on individual units Mr. Johnson found considerable advantage in being able to hoist from its position in the channel the entire bar-screen and rake mechanism for inspection, adjustment or repairs. Screenings grinders provided had been operated only on off peak current hours for power economy. Clarifier mechanisms had undergone a marked change to high grade reduction gears and replaceable wearing parts where needed most, center pier bearings being a marked improvement also.

Concerning pumps, Mr. Johnson said that crude sludge pumps proved the chief problem and, like sewage, sludge should always be screened ahead of pumps. In centrifugal pumping of activated sludge wearing ring troubles had been a chief difficulty. Based on 7 years' experience Chicago now employs pumps of special design employing nitrided cast-iron for stationary rings and high chrome steel (1/16") ring on impeller. For transfer and return of activated sludge the low efficiency air lift was preferred for reduced maintenance, its flexibility and dependability. In air blowers high class high cost units were justified; air filters of the travelling multi-panel type had been chosen. After 12 years of service diffuser plates in the North Side plant had required no special attention.

Regarding sludge filtration and disposal, the filter cloth was perhaps the most important item, since it could well be the "bottle-neck" in the system. Chicago had settled on a cloth of virgin wool of a weight 12 oz./sq. yd. Lime is not used in Chicago conditioning, and Monel metal sludge scrapers are employed. Rubber diaphragm ferric chloride pumps had proven best and pH recording equipment a material aid in sludge conditioning control. At Chicago sludge is elevated only in fluid form. In the flash-drier units bar abrasion had been the principal problem, now corrected by employing e a s i l y replaceable wearing sleeves over the bars.

It might be truthfully said that the turn toward mechanical equipment had been responsible for better sewage treatment and more and better mechanization was to follow.

Prof. Chas. Gilman Hyde, of the University of California, was unable to attend. His prepared discussion was read by T. R. Kendall, Editor, "American City Magazine"—admittedly with some difficulty in pronouncing some of the Professor's

tongue twisters. Commenting on the profound changes in design and equippage of large plants, making for continuous higher order of operation and supervision, Prof. Hyde voiced the feeling that mechanism of the small plants could be overdone and simpler design had its place in such plants. It was, however, reassuring to see that equipment manufacturers were developing devices specifically designed for sewage service and not a mere adaptation of industrial equipment. He then voiced two "pet peeves"—the first being the very difficult and needless coined names for recent equipment items. He hoped that there would never be a "Biofloccugester" put on the market. The other peeve voiced was the deficiencies of present day catalogs, apparently aimed more at the school child than in producing useful information for the engineer expected to employ the equipment catalogued, or to learn something from the advertising page. Pictures had all but completely displaced basic information and useful performance records so much to be desired. The complete hiding of prices completed the deficiencies of present day catalogs.

Sludge Gas Utilization

"The Utilization of Sludge Gas" by Ralph E. Fuhrman, Ass't Supt., Sewage Treatment Works of Washington, D. C.

Without question Mr. Fuhrman's paper constitutes the most thorough review of progress in and status of the utilization and conversion of by-product digestion gas into useful and money saving power that has yet been produced. The accompanying table reveals the steady expansion in by-product power production from sludge gas engines at sewage treatment works. This was sufficient evidence of the proven worth of the method, which received its impetus from Walraven's successful installation of the first continuously operated gas engine at Springfield, Ill., in 1932 and followed by the second unit two years later. (Earlier gas engine installations are recorded for Plainfield, N. J., by John R. Downes in 1926; by Wm. Piatt at Charlotte, N. C., in 1926; at Rockville Center, L. I., by Weston Gavett in 1930; and at San Bernardino, Calif., by Frank S. Currie, the same year. However, it was the Springfield installation that proved the practicability and unquestionable merit and economy of *continuous* operation of the slow speed type of engine.—Ed.)

TABLE I

SLUDGE GAS ENGINE INSTALLATIONS IN THE UNITED STATES

Year	Location	No. of Units	Horsepower*	Driving
1926	Plainfield, New Jersey	2	15	Blower
1928	Charlotte, North Carolina	1	225	Blower
	Charlotte, North Carolina	1	75	Pump
1930	Rockville Centre, New York	1	30	Blower
	San Bernardino, California	1	40	Generator
1932	Rockville Centre, New York	1	60	Blower
	Springfield, Illinois	1	180	Blower
1934	Springfield, Illinois	1	157	Bl. & Gen.
1935	Los Angeles County, California	1	200	Pump
	Cedar Rapids, Iowa	1	210	Generator
	Palo Alto, California	1	40	Generator
	Ontario, California	1	40	Blower
	Madison, Wisconsin	1	230	Blower
	Ann Arbor, Michigan	1	120	Blower
	Peoria, Illinois	1	535	Blower
	Peoria, Illinois	1	300	Blower
	Durham, North Carolina	2	150	Generator
	Greencastle, Indiana	1	50	Blower
	Toledo, Ohio	1	300	Pump
	Toledo, Ohio	1	225	Generator
1936-7	New York City, New York—			
	Coney Island	3	300	Generator
	District of Columbia	1	1200	Generator
	Janesville, Wisconsin	1	30	Generator
	Topeka, Kansas	2	180	Blower
	Richmond, Indiana	1	120	Blower
	Edwardsville, Illinois	1	15	Generator
	Sheboygan, Michigan	2	120	Pump
	Green Bay, Wisconsin	1	120	Generator
	Green Bay, Wisconsin	1	90	Generator
	Fort Atkinson, Wisconsin	1	40	Generator
	LaCrosse, Wisconsin	2	90	Generator
	Hutchinson, Kansas	1	90	Generator
	Elmhurst, Illinois	1	30	Generator
	Kokomo, Indiana	1	45	Generator
	Kewanee, Illinois	1	30	Generator
	Wichita, Kansas	1	70	Pump
	Litchfield, Illinois	1	30	Generator
	Dixon, Illinois	1	30	Generator
	Chicago Heights, Illinois	1	125	Blower
	Atlanta, Georgia—			
	Intrenchment Creek	2	120	Generator
	Clayton	2	180	Generator
	Grand Rapids, Michigan	1	50	Generator
	Aurora, Illinois	2	70	Pump
	Madison, Wisconsin	1	230	Generator
	Monroe, Wisconsin	1	30	Generator
1938	New York, New York—			
	Tallmans Island	2	800	Blower
		2	450	Blower
		2	350	Pump
		2	150	Pump
	Columbus, Ohio	3	750	Generator
	Detroit, Michigan	1	364	Generator
	Fort Dodge, Iowa	1	275	Generator
	Lansing, Michigan	1	240	Blower
	Oshkosh, Wisconsin	2	160	Generator
	Albuquerque, New Mexico	1	150	Generator
	Findlay, Ohio	1	90	Blower
	Battle Creek, Michigan	1	50	Pump
	Newcastle, Indiana	1	45	Blower
	Crawfordsville, Indiana	1	44	Blower
	LaPorte, Indiana	1	27	Generator
	Greensboro, South Carolina	2	160	Generator
	Michigan City, Indiana	1	74	Generator
1939-40	Greenville, South Carolina	2	225	Generator
	Springfield, Missouri	2	198	Generator
	Rock Island, Illinois	5	125	Pump
	Rock Island, Illinois	2	75	Pump
	Rock Island, Illinois	1	75	Generator
	Cedar Rapids, Iowa	1	100	Pump
	Belleville, Illinois	1	100	Blower
	Sharon, Pennsylvania	2	80	Generator
	Butler, Pennsylvania	1	80	Generator
	Wausau, Wisconsin	1	75	Generator
	Wausau, Wisconsin	1	50	Generator
	Wausau, Wisconsin	1	50	Pump
	Pueblo, Colorado	3	75	Pump
	Manitowoc, Wisconsin	1	75	Pump
	Manitowoc, Wisconsin	1	35	Pump
	Davenport, Iowa	1	75	Generator
	Davenport, Iowa	1	75	Pump
	Kenosha, Wisconsin	2	75	Pump
	Stevens Point, Wisconsin	1	75	Generator
	Marion, Indiana	2	75	Blower
	Marion, Indiana	1	50	Pump
	Ithaca, New York	1	50	Pump
	Lake Charles, Louisiana	1	50	Blower
	Carlsbad, New Mexico	2	50	Pump
	Metairie, Louisiana	1	50	Blower
	Two Rivers, Wisconsin	1	43	Blower
	Two Rivers, Wisconsin	1	40	Pump
	Escanaba, Michigan	1	40	Generator
	Shawano, Wisconsin	1	35	Generator
	Litchfield, Illinois	1	30	Generator
	Monroe, Michigan	1	25	Pump
	Gary, Indiana	3	175	Pump
	Gary, Indiana	2	300	Blower
	Cleveland, Ohio	2	390	Blower
	Fort Wayne, Indiana	1	450	Blower
	Adrian, Michigan	1	45	Blower
	Peru, Indiana	1	45	Blower
	Pontiac, Michigan	1	150	Blower
	New York City, New York—			
	Jamaica[1]	3	1440	Generator
	Coney Island[1]	3	920	Generator

[1]Not yet installed. *H.P. of each unit.

Mr. Fuhrman pointed out that between 500 and 900 B.T.U. per capita, daily, represents the money value of sludge gas available at sewage plants if effectively put to useful work. After reviewing the use of this by-product fuel in heating plants and in screenings, grit, and sludge drying and incineration, and even the burning of garbage, Mr. Fuhrman gave major attention to the more spectacular gas utilization for power development with heat recovery as the by-product of a by-product. Tracing the growth of engine installations from 1926 to date, Mr. Fuhrman stated that of the 135 engines listed 29% drive pumps, 28% drive blowers and 47% electric generators. (Mr. Fuhrman recorded total H.P. installed for the 135 units at 14,500 but this figure is low by at least 4,000 H.P. and probably more—Ed.)

Concerning engine design, except for valves of corrosion resistant alloy to withstand possible acid attack due to hydrogen sulphide in the gas, the engines are of standard gas engine design throughout. The upper limit of H_2S in gas for safe operation is commonly set at 10 grains/100 cu. ft. and but few sludge gases exceed such concentration, which requires scrubbing to remove the sulphides. Fuel requirements per B.H.P. at full loading has varied from 8,400 B.T.U. for the 1200 H.P. engine at the Washington plant to 14,500 B.T.U. for a 45 H.P. unit at Ontario, Calif. The commonly guaranteed efficiency is 10,000 B.T.U. per B.H.P. at full engine loading and gas of 600 B.T.U. per cu. ft. The success of gas engines is responsible for the complete severance of electric power from the outside and such is being planned now by a number of plants, including Aurora, Ill., and the Washington plant where an additional 1500 H.P. unit and a Diesel engine of 750 H.P. will give 3450 installed H.P. A saving of $13,000 annually had already been recorded for the 1200 H.P. Washington unit, whereas an eventual $23,000 saving is expected, these figures including all fixed and operating costs for the engines. Energy recovery at Washington has been represented by 23% in electrical power; as jacket water (heat recovered in digesters) 30%; as steam from exhaust heat 12%; losses in all forms 35%—representing a net recovery of 65% of B.T.U. input, and 50% of the total heat generated is recovered for useful purposes.

From this point Mr. Fuhrman discussed heating of digestion tanks now most commonly attained with a steam type boiler and heat exchanger, rather than a hot water boiler which suffers greater corrosion. Then he dealt with hazards in handling gas and safety measures including the successfully used automatic alarm system revealing the presence of combustible mixtures of gas and air at danger points about the plant. He closed with the thought that a trend to garbage digestion at sewage plants may yield sufficient gas to put the combined wastes disposal works on a handsomely profitable basis of power generation. Perhaps the sleek and noiseless gas turbine of to-morrow will supplant the engines of today as steam turbines have reciprocating engines.

Robt. A. Allton, Supt., Sewage Treatment Wks., Columbus, O.

G. T. Luippold, President, Luippold Eng. Sales, Los Angeles.

E. F. Eldridge, Research, Associate, Eng. Exptl. Sta., East Lansing, Mich.

W. B. Walraven, Chief Engr., Sanitary District of Springfield, Ill., rather blushing from the credit given him as the man who put by-product power production from gas engines on the map, was a discussor. He stated that a convenient figure to remember was the conservative estimate of 2 H.P. per 1000 pop. served by a sewage plant. In numerous instances gas engines, after paying for the installation in the first few years, will show a profit sufficient to amortize all digestion costs. Topeka, Kansas is now independent of outside power and Aurora, Ill., with two more engines ready to go is to cut off outside power source. These new engines have auxiliary gasoline carburetors "just in case." The answer to possible H_2S pitting is to scrub the gas —a simple inexpensive procedure. At Springfield 0.1% H_2S in the gas has caused no noticeable difficulty, although exhaust valves do pit to some extent.

Wm. A. Hansel, Sewerage Engineer, Atlanta, Ga., related a novel "recirculation scheme" in gas utilization at Atlanta. Sludge gas is piped to the State Penitentiary and used for cooking and heating. The gas is returned to the plant in the form of sewage and kitchen wastes, from which it is "recovered" in the digesters for return again to serve the original source—(the prisoners) in an unbroken chain of production, utilization, and recovery. [This scheme, which has its points, produced a ripple of amused laughter. —Ed.]

Dual Disposal of Sewage and Garbage

(Proved Most Interesting Program Topic)

"Dual Disposal—Where Does It Stand?"—by Edward J. Cleary, Assoc. Editor, "Engineering News Record," New York City.

Mr. Cleary as "an impartial observer" took a look at the question of "How practical is dual disposal of garbage with sewage?" by bringing up to date the available information on the subject, and then closed by propounding some questions requiring consideration. The story of dual disposal had its beginning in Lebanon, Pa., in 1923 when ground garbage was for a short period (insufficient for conclusive evidence) sent down sewer to the local Imhoff tanks. Then 10 years passed before Chapter II was written, when Baltimore, Md., was forced to dispose of a portion of its garbage by the sewer route, and at Indianapolis, Calvert and Tolman conducted a rather thorough going study of the effects of ground garbage on the Indianapolis plant. [The findings and conclusions appeared in WATER WORKS & SEWERAGE for May, 1936.] Now Chapter III is being written at Lansing, Mich., where the pioneer full scale plant for dual disposal has been in operation 14 months. Other cities now adopting the scheme include Findlay, Ohio; Goshen, N. Y.; Marion, Ind.; Rock Island, Ill., and the largest that of Gary, Ind., where the new activated sludge plant has been liberally designed to receive the garbage of this city. A year hence much more can be written on this newest sanitary engineering undertaking, to add knowledge to that gained at Lansing, Mich.

Some considerations involve the following. Increasing organic content of the grit at Indianapolis presages more thorough grit washing. The increase in primary tank sludge (Indianapolis) may be 17 to 28% by volume, although 25% of the garbage solids passed through the primary tanks to load the secondary process. Indications, said Mr. Cleary, are that these non-settleables

will increase the secondary process loading by 43%, although there is variance of expert opinion concerning the extent of such loading increase, the quality of garbage being the controlling factor. At Indianapolis, Calvert concluded that increased plant capacity would amount to only 3%, while Tolman estimates a 11% increase in power for aeration in the bio-flocculation process as there employed.

Turning to the matter of digestion of the solids, indications based on laboratory studies are that the ratio of garbage to sewage solids from a community constitutes a satisfactory digesting mixture—with 1 to 1 the limit on a dry basis. Gas production varies between 8 and 13 cu. ft./pound of volatile solids added, and methane content of the gas ranged from 57 to 65%, the CO_2 content being up thereby.

Looking at the actual operating records of the Lansing plant, for the past year (21 tons of ground garbage daily from 75,000 population added direct to digesters, without benefit of washing by addition to the sewage flow) the following are pertinent facts. Digestion at Lansing has been satisfactory and the gas O. K. for engine operation and burning. An important difficulty is that the supernatant liquor is really thin sludge (2% and better solids) which creates activated sludge bulking when bled to the crude sewage. On a volatile solids basis the solids ratio has been 1 garbage to 1.4 parts of sewage solids, the digesters providing 4 cu. ft./capita. The digested sludge dewaters without difficulty on vacuum filters. Gas production had increased 230% and averages 11.3 cu. ft./pound of volatiles added to the digesters. CO_2 increase had been but 6%—there being 37% total in the combination gas without gas engine difficulty resulting. A chief difficulty has been the indigestibles of the garbage, although Lansing garbage is s e p a r a t e d and paper wrapped. Such things as bottle caps, fruit pits, bones (an occasional spoon or fork perhaps?—Ed.) have a remarkable way of stranding in vulnerable points, such as valve seats and pump valves. Plans are under way at Lansing to "degrit" the ground garbage and crude sludge mixture before digestion. Stage digestion is also planned because of the deleterious supernatant liquor quality.

The fact that garbage and sewage solids can be digested together has been amply proven, said Mr. Cleary, but many practical considerations

Chas. R. Velzy, Supt.
Sewage Treatment Works,
Buffalo, N. Y.
W. F. Shephard, Asst. Engr.
Michigan State Dept. Health,
Lansing, Mich.
F. Woodberry Jones, Ch. Chemist,
Havens & Emerson, Engrs.,
Cleveland, Ohio

have yet to be answered. The most important of these is the relative overall cost of the wet method vs. incineration, wherein rubbish must be disposed of in any event. The questions yet to be answered are the following: (1) Whether to admit the garbage to the sewers, and at what point (Gary, Ind.), or to the digesters direct (Lansing)? (2) What additional digester capacity to provide under each method? (3) What additional plant capacity and power requirement for the secondary process, under each method? (4) What is the comparative cost with established methods of garbage disposal?

To the last question some indications are had from Indianapolis and Baltimore. The Calvert estimate was 57 cents per ton of green garbage including all costs, other than added digestion tanks, since Indianapolis lagoons sludge. (Indianapolis did not adopt the method because of the existing garbage reduction plant, which was revamped and continued. —Ed.) Keefer at Baltimore on the other hand (separate digestion and trickling filters requiring no power) calculates the overall cost at $3.20 per wet ton of garbage. Of this, $2.81 was the estimated cost for added digestion facilities and open sand drying beds. Against such costs the added value of gas produced must be considered—at Lansing its value is reported at $9,000 per year and Gary anticipates minimum added power production worth $13,000 per year. When considering the added cost for collection and handling of garbage, rubbish and ashes separately, much of the gas power gain disappears. Therefore, for a sounder answer to the question "What Cost Dual Disposal?" more data is essential and time must pass while actual experience, from plants now going in, gives us the answer on a less speculative base than is now possible. Incinerator design to care for rubbish alone may have to be changed. The cost of garbage separation, collection and preparation for digestion is a matter of eminently practical concern, because collection of rubbish and ashes must be continued just the same. These, said Mr. Cleary, are the critical questions having a weight equal to that of increased *net* cost of sewage plant construction and operation.

Louis R. Howson, Consulting Engineer, Chicago, Ill., long engineer advisor to Gary, Ind., and designer of Gary's new treatment plant, as a scheduled discussor agreed with Mr. Cleary's conclusions in general. A study of economies in the Gary situation brought on the decision to design the new plant for dual disposal for the reason that Gary had adequate incinerator capacity for rubbish but not for garbage. When credited with the anticipated additional power production, dual disposal proved (on paper at least) to be cheaper by $12,000 annually than providing and operating adequate incinerators.

Pointing out that the safest means of avoiding pitfalls in pioneer work was to design liberally, Mr. Howson directed attention to design data at Gary. The digester capacity as admittedly liberal at 6 cu. ft./capita for ultimate service and 9 cu. ft./capita for the present loading. The thought in mind was to provide for peak summer loadings when garbage reaches peaks that test the liberal design of incinerators. In digester proportioning, the area has been increased above standard sewage design in consideration of anticipated violence of gas generation at rates in excess of 2.5 cu. ft./capita during summer conditions. The design rate is 6 cu. ft. of gas per 24 hrs. per square foot of area and should not "boil" or foam to the extent of earlier digesters, thereby creating a "soupy" supernatant. There are 8 digesters subject to single or two stage operation at Gary.

In order to "wash" the garbage and allow grit separation the Gary garbage grinders are situated on the sewer entering the plant, but on the plant property and under control and supervision of the sewage plant manager. The prepared garbage must pass the regular plant comminutors and through mechanically cleaned grit-chambers equipped for washing. Provisions for air supply has been made extremely flexible. Up to 14,000 cu. ft./min. (0.5 cu. ft./gal.) is to be gas-engine produced, out of a total of 1.25 cu. ft./gal. available. The garbage load on aeration facilities is estimated to require 15% ad-

ditional air. Gas storage of 200,000 cu. ft. at Gary is admittedly liberal to bridge over garbage deficiency periods and lowered gassing rates. Plans have been laid to begin receiving garbage gradually and subsequently extending to the complete city, with ultimate loadings of 30 to 35 tons daily.

Morris M. Cohn, City Sanitary Engineer of Schenectady, N. Y., who has long proposed and agitated the question of dual-disposal and household disposal of garbage via the sewer system, said that he had 8 years ago raised all questions propounded by Mr. Cleary and felt that a negative attitude was the erroneous path.

Asked the question, "what would be his recommendation as to minimum digester capacity in dual disposal?", Mr. Cohn said that overdesign was the most intelligent path to take. He thought that not less than 6 cu. ft./capita should be provided, with stage digestion as the best practice on account of the supernatant problem experienced at Lansing.

The question of probable scum build up in dual digesters was raised by *Dr. Rudolfs,* based on experience with digesting fine screenings. In reply thereto *W. F. Shephard,* of the Michigan Dep't of Health, said that no scum troubles had been heard of at Lansing, probably because the Lansing digesters were equipped with mechanical agitators. He described the garbage collection system of Lansing in which the full cans are brought to the plant emptied, washed, steamed and returned. The method insures a well separated garbage ideally suitable to dual-disposal except for bones, pits and bottle-caps.

Mr. Howson, in reply to the question of "Why is the garbage dumped into the sewer, as long as it has already been delivered to the plant, and not handled as Lansing does it?"—stated that the method was principally adopted to remove those materials that caused troubles in Lansing, by way of the Gary grit chambers. Also it was believed that improved primary clarification would result.

(Although clarification may be improved, the question of the extent of increased B.O.D. of the primary effluent due to elutriation effects in the clarifier and the washing out of juices, emulsified fats, carbohydrates and protein colloids from the garbage, may well be a more important consideration in comparing the two methods. However, no better means of separation of the trouble-making elements, than grit chamber treatment, has yet been suggested. Further to be considered in this method is the washing away of some gas producing values.—Ed.)

"Round-Tablers"

Morris M. Cohn, City San. Engr., Schnectady, N. Y.
(Pioneering Sludge Salesman)

Walter A. Sperry, Supt. Sanitary District of Aurora, Ill.
(His Plant a "Mouse-Trap Factory")

R. W. Frazier, Supt. Treatment Wks., Oshkosh, Wisc.
(Up in Wisc. they call him "One Bushel" Frazier)

"The Operators' Breakfast"

(M. W. Tatlock and K. L. Mick—Presiding)

As is customary at meetings of the Central States Association, the "Operators' Breakfast" was held for the purpose of informally discussing plant operating problems and their solution. The need for rushing through the topics on the agenda in something less than the single hour available was to be regretted. Many problems failed to get aired and many operator's questions were not reached.

Topic No. 1
Sludge as a Soil Improver

The how and why of sludge use as a soil improver was brought out by the Chair who put questions to operators from coast to coast regarding practices and experiences, and received the following replies.

In San Francisco, the Park Department takes 75% moisture sludge cake for spreading on park areas at no cost.—*Benj. Benas.*

Of New York City's 260 tons daily of dry solids, removed from sewage in 3 plants, only 7 tons daily is digested, the balance going to sea in tankers. The digested sludge is drawn into barges direct from digesters and turned over to the Park Dep't for spreading on sandy areas. Fine screenings from 2 plants, formerly a nuisance, are disposed of in a similar manner.—*Wellington Donaldson.*

From the Indianapolis lagoons, at no charge market gardeners took away 35,000 cu. yds. in 1939.—*Don. Bloodgood.*

From the 4 plants of Greenwich, Conn., all digested sludge (sand bed dried and shredded) goes free to residents and golf courses.—*Guy Griffin.*

Dayton, Ohio, continues to dry digested (Imhoff) sludge, pulverize or shred it, and wholesales it in bulk to fertilizer companies. Some is bagged and sold retail. Starting in 1931, peak sales of 2100 tons (dry) was reached in 1938, whereas limited production since had reduced total sales. Practice now is to heat dry and pulverize sand bed cake only to the extent that labor costs do not exceed the maximum economy curve developed for routine operation. Forced production, proved to cost more than is gained, and "new sales records" have had to go in preference for less glamorous but sounder economy records. Dayton's sewage (essentially domestic) yields 0.66 tons of Imhoff digested solids (dry basis) per M.G.—*M. W. Tatlock.*

Toledo, Ohio, continues to produce "Toledro." Selling the entire output, without price cutting, gross sales of $10,000 last year yielded a profit of $6,000. The secret to sludge sales is merchandizing. Considering the thought that sewage sludge contains growth promoting elements not procurable in ordinary commercial fertilizer, sludge may be considered to have a value peculiar to itself.—*Henry Niles.*

(Of this matter of growth promoting substances in sludges more will be heard in a forthcoming paper to appear in this magazine. It comes from a well known Agricultural Expt'l. Station by a well known authority.—Ed.)

Schenectady, N. Y., a pioneer in building up a demand for bed dried digested sludge, has been getting rid of sludge for 16 years—one way and another—but made the early mistake of trying to give it away. Farmers wanted to know "What's wrong with the stuff?"; then the old trading instinct came to life and a charge of 10 cents for a load (any kind of load —any size) did the trick. Proving its 10 cents "introductory offer" value, the demand increased; and sludge reserve decreased. It was time to raise prices—scarcity excuse —and at 25 cents the load (150% increase) the demand grew and with it the size of trucks. Also spring breakage grew, due to packing it on too heavy. Chapter III finds "sludge crumbs" at a premium at Schenectady—they actually sweep them up. Now to save outbreaks of taker hos-

tilities (and broken springs) the set "Schenectady Schedule" is a full cubic yard at the "two-bit" minimum; two yards for twice as much; and for 75 cents "all you can get on" —but trailers barred. Perhaps the most important consideration is that the buyer likes to get the "freshest sludge" right from the beds. In this scheme each $1.00 for sludge sold means about $10.00 less labor cost for bed cleanings.—*Morris Cohn.*

Wisconsin boasts many things, amongst them the country's No. 1 tomato grower—none other than "One Bushel" (R. W.) Frazier, Sup't of Treatment at Oshkosh. Right on pure Oshkosh sludge he grows tomatoes and claims the national record of "a bushel to the bush"—leastways that's his story and he sticks to it, no marble sized fruit either. On the strength of this performance Oshkosh sludge brings a premium in Wisconsin and "One Bushel" Frazier, starting modestly in 1938, turned in sludge sale receipts of $156 for the first year. What business did he do the second year?—just $753 worth. Up to October 1st in 1940 he had in the till $760 for the 8 months, with 4 more to go.

Topic No. 2

The Solids Balance Problem

This topic has come up again with no concrete answer as to the most correct method to follow in recording solids removed by the treatment plant, and subsequent accounting during their stay in the plant. In short, the solids balance sheets refuse to check out by the methods commonly employed for the records.

C. C. Larsen, (Springfield, Ill.) commented on the two methods of solids bookkeeping commonly employed. (1) Measuring sludge volumes and computing dry solids from the laboratory findings of solids content by evaporation. (2) Measuring suspended solids in composited crude and settled samples (crucible filtration method) and computing solids retained from the difference and the day total flow.

Strangely and unaccountably, methods (1) and (2) without any consistency in direction fail to check by 20%. The questions before the house are then—"Which method yields the nearest correct solids records, and why?"—"What figure (record) should the designing engineer risk his neck on?" Mr. Larsen believes that the difficulty of effectively sampling crude sewages puts the suspended solids method on the spot, being subject to the least consistency even with weighted sampling in collecting the daily composites. On the other hand dependably representative sludge sampling is no child's play either—so "What is the answer?" On the whole, Mr. Larsen favored the sewage and effluent analyses for solids removed records.

Walter Sperry (Aurora, Ill.) said that their two records checked fairly closely but not until the tipping bucket sludge volume recorder and automatic sampler had been perfected; and not until the selective volumetric sampling cup method, used in conjunction with hourly meter readings, had been developed for hourly proportional compositing in crude sewage sampling. Furthermore, a special bucket sample collector, arranged for gradual filling, is lowered into a crude sewage channel where solids distribution is the most uniform. (These sampling devices for sewage and effluent sampling and the tipping bucket sludge meter and automatic sampler will be described and pictured in an article by Mr. Sperry in an early issue of this magazine. The writer recently visited the Aurora plant to see the workings of both these highly useful devices. This fellow Sperry runs a "mouse trap factory" at Aurora and the sewage works operator who seeks out Sperry's "factory" is well repaid.—Ed.)

C. R. Velzy (Buffalo, N. Y.), finding a large solids balance discrepancy at the Buffalo plant, concluded the fault lay with the sewage sampling on which suspended solids tests are made. He prefers to rely on solids determination on metered sludge, and the records of the reliable "Weightometer" which totalizes the weight of all sludge cake from the filters as it travels by belt to the incinerators—the difference in the methods being a matter of milliliters and grams vs. thousands of gallons and tons.

Instruction, Training and Licensing

"Instruction in Sewage Treatment"—by Gordon M. Fair, Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.

Sewage treatment, said Prof. Fair, had its birth in experiment and the papers presented at this meeting prove that it is continuing to grow in the same manner. Instruction is for the purpose of learning underlying principles, not to develop new things. He described the basic subjects and experiments which are utilized for instructing engineering students in the courses at Harvard University.

By laboratory demonstrations and student participation, the fundamental principles of gas exchange aeration, of sedimentation, coagulation, filtration, aerobic and anerobic digestion, chlorination and chlorine demand, are studied. Simple laboratory equipment is employed to illustrate these subjects, and adequate diagrams of both devices and results were shown by means of lantern slides.

Professor Fair stressed the point that laboratory experiments should be an incentive to future studies. He proposed that such methods be not limited to instruction, but be used by plant operators to solve operating problems and increase efficiency of treatment.

Discussion—by *H. E. Babbitt,* Professor of Sanitary Engineering, University of Illinois, Urbana, Ill.

Prof. Babbitt cited the Fair paper as a practical as well as academic approach to the subject. Plant operators can duplicate much of the equipment described and study these principles by themselves. An expert in the art of sewage treatment must know a wide variety of other arts and sciences. However, the course described by Prof. Fair is not designed to produce such experts.

Because a course of this type applies academic knowledge on a practical basis, its adoption is justified and should interest students. The Sewage Works Federation might do well to propose that such a course be made a part of the training of sewage plant operators.

Discussion was adequately closed by the Sup't of Treatment at Springfield, Ill., who has the distinction of being the newly elected president of the Central States Association. He was of the opinion that the academic approach to the subject has been well covered; but what the man operating a sewage treatment plant must also have to pull through on occasions is a thorough grounding in the "art" of profanity! Such was the open opinion of operator "Swede" (C.C.) Larsen—speaking as "The Voice of Experience."

"Licensing Sewage Plant Operators"—by Charles C. Agar, Senior Sanitary Engineer, New York State Dep't. of Health, Albany, N. Y.

Operator licensing first started twenty years ago in New Jersey, and it was fifteen years before another state adopted it. All recent impetus has been brought about

largely by the operators themselves.

State Health Departments have long recognized the need for trained operators, both for increased efficiency and to prevent needless turnover of personnel. While short schools, meetings, and discussions provide training, this increased ability can best be recognized by certification or licensing. Tenure of office by better qualified operators is important to the individual and to the community.

Many advantages under licensing are obvious: The plant investment is well operated. The operator is qualified, and has plant improvements as a goal, and has the respect of his superiors. There are certain qualifications of the operator which cannot be disclosed by written or oral examinations. For instance, on operator to be wholly successful must possess the proper personality, be able to handle men and cooperate.

As part of the State Sanitary Code, the New York licensing act became a law in 1937. It includes a "grandfathers'" clause and defines three grades of operators. Experience in its operation has been satisfactory to both operators as well as to the Health Department. Hiring and firing of personnel has been greatly reduced in the years since its adoption by New York State.

In the State there are now 41 operators holding Grade 1 licenses, 52 having Grade 2, and 200 Grade 3 licenses. A gradual tightening of requirements can, and should, develop in the future. Training schools provide the largest field for advancement of Grade 3 (minimum requirements) to Grade 2 operators.

A total of 28 states have seriously considered licensing, and 12 states will have such a law in effect before 1941. At least 6 of these states have a provided a "grandfathers'" clause to protect operators employed at the time of enacting the law. While the licensing laws have been in effect too short a time to draw extensive conclusions, a survey of results shows that operation of plants is attended with more interest, is more competent, more beneficial to the operator and to his community.

Discussion—by *C. W. Klassen*, Chief Sanitary Engineer, State Department of Health, Springfield, Ill.

This paper by Mr. Agar typifies the spirit of the entire meeting, said Mr. Klassen, since it combines various ideas and points of view for the first time. No plant can be better than its operator—therefore, a movement toward more general licensing should logically come from municipal officials.

The Illinois plan calls for a voluntary "certificate of competency," which gives credit and distinction not only to the operator, but to the community which employs him as well.

Mr. Klassen voiced the idea that the Sewage Works Federation can provide a program of education to interest city officials and civic groups in requiring better qualified sewage plant operators, based on attaining stream improvement.

Paul Molitor, Sr. (Sup't of Sewerage, Morristown, N. J.), discussed the background of state licensing. Nearly 30 years ago, a meeting at his plant had originated the idea of improving plant operation through cooperation of engineers and officials with those in charge of treatment plants. He had continued to be in favor of all progress in licensing and certification which leads to this end. This meeting exemplified such progress and repsents an important milestone in sewage treatment and cleaner, safer streams.

Exhibitors

The following firms constituted the supporting group of exhibitors participating in the First Annual Convention of the Sewage Works Federation. Through their support and puchase of exhibit space a net profit of better than $1,000, after deducting all convention expenses, was turned over to the Federation by Wm. J. Orchard, drafted as Chairman of the Finance Committee on the strength of his reputation in convention management in A.W.W.A., and the jobs done in connection with the successful 1940 Silver Anniversary of the New Jersey Sewage Works Association:

Aluminum Co. of America.
American Brass Co.
American Cast Iron Pipe Co.
American City Magazine.
Ayer McCarel Reagan Clay Co.
Builders Iron Foundry.
Carson-Cadillac Corp.
Carter Ralph B. Co.
Chain Belt Co.
Chapman Valve Mfg. Co.
Chicago Pump Co.
Crane Co.
Dorr Co.
Dow Chemical Co.
Engineering News Record.
Everson Mfg. Co.
Fairbanks Morse Co.
Farnham, F. D., & Co.
Foxboro Co.
General Chemical Co.
General Electric.
Homelite Corp.
Inertol Company, Inc.
International Filter Co.
Jeffrey Mfg. Co.
Johns-Manville.
Lakeside Engineering Co.
Linings, Inc.
Link-Belt Co.
Lock Joint Pipe Co.
Mathieson Alkali Works, Inc.
Merco Nordstrom Valve Co.
Monsanto Chemical Co.
Mueller Co.
Nichols Eng. & Research Corp.
Pacific Flush-Tank Co.
Pennsylvania Salt Mfg. Co.
Pittsburgh Equitable Meter Co.
Portland Cement Association.
Proportioneers, Inc.
Public Works Magazine.
Rasher & Betzold.
Royer Foundry & Machine Co.
Sewage Works Engineering.
Simplex Valve & Meter Co.
Smith A. P. Co.
Tapax Manufacturing Co.
Tennessee Corp.
U. S. Pipe & Foundry Co.
Vogt Mfg. Co.
Wailes Dove-Hermiston Corp.
Wallace & Tiernan Co., Inc.
WATER WORKS & SEWERAGE.
Wood R. D. Co.
Yeomans Bros. Co.

The Protective Film in Silicate Treatment

For a good while now sodium silicate has been added to waters for the purpose of suppressing corrosion of metals, and especially pipe lines in hot water systems. The quantity of silicate requisite has been extremely small and periodic cessation of treatment, or temporary under treatment has not been of noticeable effect. In fact intermittent treatment by the "off and on" method has proved satisfactory and money saving. Examination of pipes revealed the reason for success in the intermittent treatment to be due to a thin but effective protective "skin" laid down very uniformly on the pipe walls. This "skin," by chemical analysis and petrographic examniations, has been shown to consist of flat crystals of calcite (calcium carbonate) which are cemented together with silicate of calcium.

This observation would indicate the value of passing very soft waters through contact beds of limestone, or adding limestone dust or calcium in some other form, supplemented by silicate treatment. Also it indicates that zeolite softened water of zero hardness is not subject to the most effective film production from silicate applications unless some calcium salt is also added.

AMERICAN WATER SOFTENING PLANTS OF ESPECIAL INTEREST

Part I. of a Running Account of Observations Made During a Tour of Nineteen Typical American Softening Plants

By L. J. ALEXANDER
Operations Engineer
SOUTHERN CALIFORNIA WATER COMPANY
LOS ANGELES, CALIFORNIA

The Author

WATER softening in the United States is accomplished in many ways with varying degrees of success. The successful plants are those which have been well designed and are operated by competent personnel. Operators, generally, are trained chemists or engineers with special qualifications. There are many reasons for failure of a plant to perform its proper function, but three causes of failures stand out—poor plant design, misconception of proper treatment, and poor operating personnel. A plant of proper design, if operated by unqualified men, cannot function properly. On the other hand, well trained operating personnel may attain exceptional results with a poorly designed plant.

An example of the ideal combination, a well designed and well operated plant, is the one at Springfield, Ill. A badly designed but well operated plant is that at Elgin, Ill.

There is always the problem of trying to attain success with a plant whose capacity is not sufficient to meet the needs. Often new additions to a plant to meet increased demands may overcome original deficiencies. Where this is done, both the designer and operator are to be commended. Oklahoma City, Topeka, Kan., and Woodstock, Ill., are examples of such accomplishments.

Of especial interest are those plants whose designs have met a certain specific problem, such as very turbid water, an extremely hard water, a special type of treatment, or plants where experimental work of some nature is in progress. In this group are Topeka; Oklahoma City; Springfield, Woodstock and La Grange, Ill.; Williams Bay and Greendale, Wis.; Consolidated Electric in New York City, and the Chemical Laboratory at Texas Technological College at Lubbock, Texas.

The plant at Topeka has been enlarged and rebuilt and is now accomplishing exceptional results with a very turbid raw water.

The Oklahoma City plant was also enlarged, but the experimental work in the development of the under-water burner for recarbonation and the merging of sludge with lime slurry is of prime interest there.

The plants at Springfield and Woodstock warrant attention because of the Spaulding precipitators. These plants make use of the up-flow of mixed water through a sludge blanket in a sedimentation basin.

The plant at Williams Bay, Wis., uses a sludge blanket, but attains results by a different principle of operation. This plant also deserves mention because it is entirely automatic.

Greendale, Wis., has an automatically controlled zeolite plant.

The plant at La Grange, Ill., deserves attention because it uses a combination of lime and zeolite for softening. This plant is now successfully using a method which proved a failure at Findlay, Ohio.

The Consolidated Edison plant uses the new carbonaceous (hydrogen) zeolite to treat a water for special uses. This plant operates the zeolite on the sodium and hydrogen cycles and produces a satisfactory boiler feed water.

At his laboratory in Lubbock, Texas, Dr. Goodwin is doing significant experimental work on removal of flourine from water.

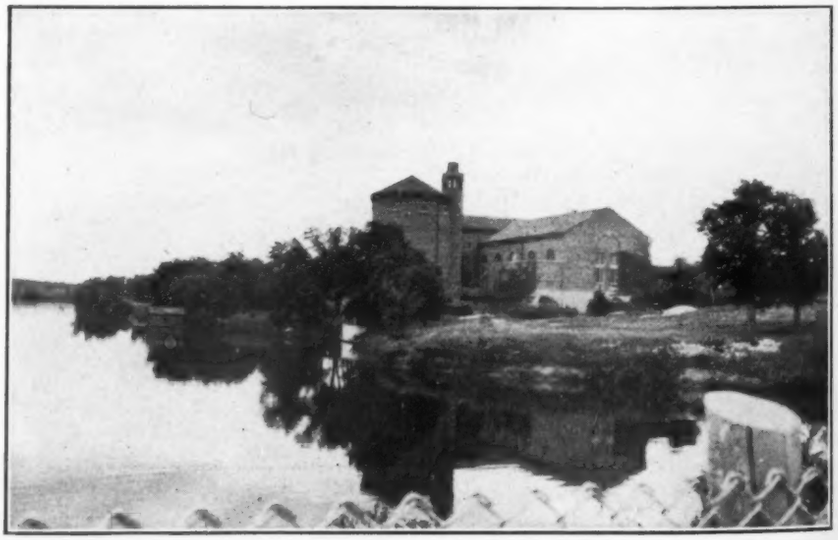
No set of notes could be complete without reference to the work by Mr. C. P. Hoover on all phases of water purification at the plant in Columbus, Ohio, and the work by Mr. John R. Baylis on taste and odor control at the Chicago experimental filter plant.

During August, 1939, nineteen water softening plants were visited by the writer. Brief comments on several of these plants follow:

Oklahoma City

Oklahoma City, Okla., has a population of approximately 210,000. It has a filtration plant originally designed to soften 16 M.G.D.

By the installation of two Dorr Clarifier tanks, the plant was increased to 24 M.G.D., but in periods of



The Softening Plant of Bloomington, Ill.
(Architecturally a Country Chateau in a Pretty Setting on the Lake.)

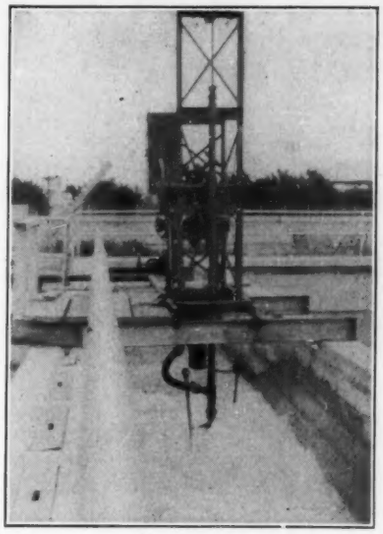
heavy draft, 32 M.G.D. have been treated and a satisfactory effluent produced.

The source of supply is the North Canadian River, on which an impounding reservoir has been constructed. The impounding reservoir was necessary due to the intermittent flow characteristics of the river. Flow varies from flash flood stages to a dry stream bed at the filter plant. Turbidity of the impounded water, caused by a red colloidal clay, varies from 100 to 13,000 p.p.m. The river has an average alkalinity of 265, a carbonate hardness under normal conditions of 385 p.p.m., a chloride content often higher than 150 p.p.m., and a pH of approximately 8.4. This water is softened to between 100 and 125 p.p.m. with a final pH of 9.6, but water of 80 p.p.m. hardness has been produced.

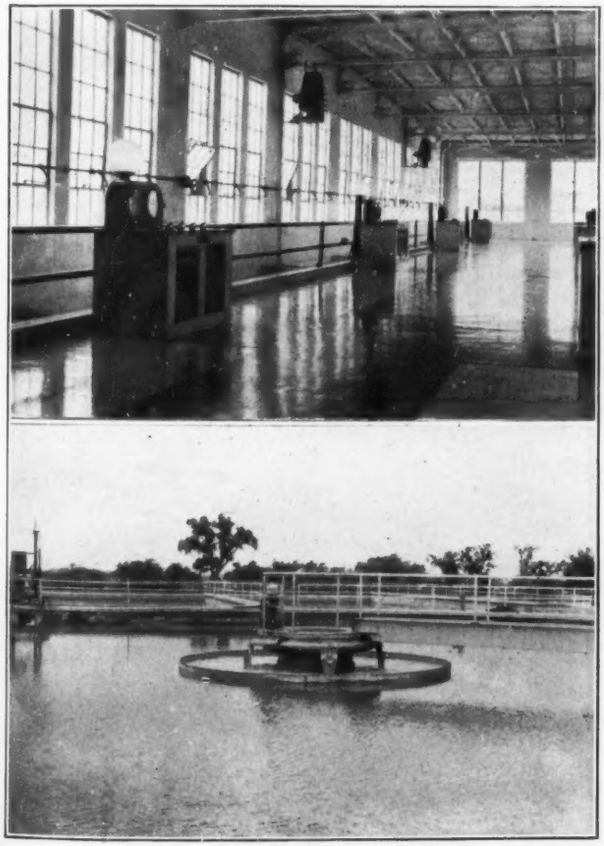
Mr. L. H. Scott, in charge of this plant, stopped using copper sulfate in his reservoir six years ago following the development of a moss on the sides of the reservoir. From his description, it may be assumed that a condition of biological balance exists so that copper sulfate treatment is not necessary.

Lime is used for softening; soda ash is used only when necessary. There is no aeration. The mixing basin has a flash drop and around-the-end channels. About 5 per cent of the sludge from the Dorr clarifier is returned to the raw water. To this return sludge all of the chemicals for treatment are added while en route to the raw water. Mr. Scott believes that this is one of the reasons for obtaining good results in the treatment of this water.

Mr. Scott is using the original Scott-Darcy contact tower for making ferrous chloride, which he uses as coagulant. This is the scheme he developed for making ferrous chloride for use in the chemical precipitation of sewage. With ferrous chloride there is always the possibility of passing soluble iron beyond the filters, but with complete reaction which is obtained in the Dorr clarifier, no soluble iron has, as yet, been found in the effluent from the filters.



At Oklahoma City
The Unique Recarbonation Scheme, Involving Under Water Gas Burning, Which Dispenses With Generators, Scrubbers and Compressors.



The Oklahoma City Plant
(Above)—The Immaculate Interior. (Below)—The Efficient Clarifiers.

The Dorr sedimentation tanks, having a short retention period (60 minutes at 16 M.G.D.), show excellent results. From these clarifiers the water passes to the recarbonation unit. The recarbonator is an under-water burner, which Mr. Scott has developed, in cooperation with the Ozark Chemical Company of Tulsa, Okla., from a German patent. This method of recarbonation, having an efficiency of about 86 per cent, eliminates the necessity of a scrubber and drier, and eliminates the handling of corrosive CO_2 gas through a blower. The process has been described in an article appearing in WATER WORKS & SEWERAGE in 1939.

Mr. Scott had an experimental plant for the reburning of lime sludge. These experiments were carried out following passage of a law by the State of Oklahoma prohibiting stream pollution. The process as finally worked out proposes the use of a large portion of the reburned lime for chemical precipitation in the Oklahoma City sewage disposal plant, which is also under Mr. Scott's supervision. By such a program the quantity of lime purchased can be cut in half. Thus half new and half reburned lime may be used at the softening plant. The balance of the reclaimed lime would then go to the sewage treatment plant. Thus, it would be possible to suppress the accumulation of inert magnesium in the sludge, even should there be a quantity of magnesium in the raw water. From his experimental work Mr. Scott was doubtful whether calcining would work on a 100 per cent basis if the magnesium is over 50 p.p.m. From the standpoint of sludge disposal only, which was the point of their study, it was found to be an economical process.

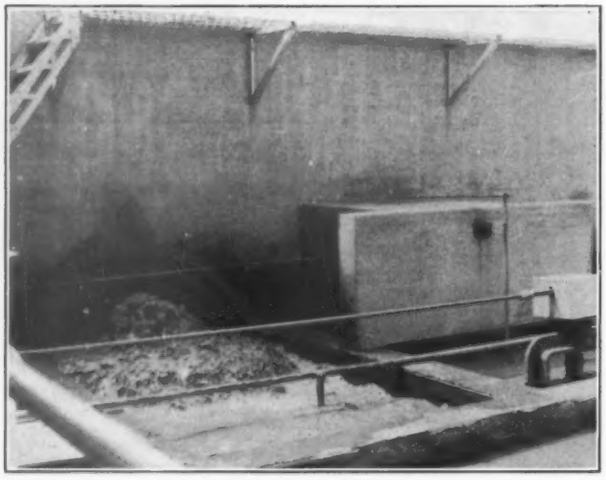
At the time the Dorr clarifiers were constructed, the filters were overhauled and the sand was replaced with "Anthrafilt." By using anthrafilt in place of sand, the

filters, with a rate of over three gallons per square foot per minute, have shown satisfactory operating results. ["Anthrafilt" is crushed and graded anthracite coal.]

Topeka, Kansas

The West End Plant of Topeka, Kan., under the direction of Daniel H. Rupp, is treating approximately 5,000,000 gallons of water daily. Approximately 15 per cent of the supply is derived from wells; the balance is taken from the Kansas River by low lift pumps located in a well near the river bank. The discharge of these pumps is through an "Aero-mix" aerator, though it is not ordinarily necessary to aerate this water. These devices would make excellent flash mixers, however.

Following aeration, the water enters a grit chamber where heavy sand particles, or grit, are precipitated. From the grit chamber the water passes through Dorr flash turbo-mixers, where it receives its chemicals. Depending upon the character of the raw water, which has an average of 3,000 p.p.m. of turbidity and an average hardness of about 244 p.p.m., soda ash is added in addition to lime for softening. These chemicals are

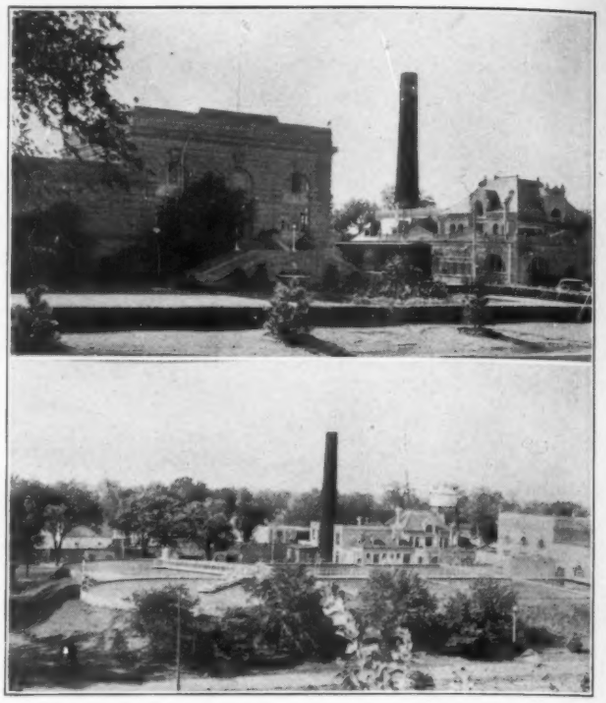


One of Topeka's Battery of "Aero-Mix" Aeration Units

added in sufficient quantity to soften the water to 80-90 p.p.m. Alum is also added for coagulation at this point. There is also a small percentage of sludge from the clarifiers returned to these mixers.

Following the flash-mixing the water passes through a chamber in which are installed Dorr flocculators. From the flocculators the water passes through a central multiple-barrel conduit to new Dorr clarifiers. These units have peripheral weirs over which the clarified water flows. It then returns to secondary flash-mixers, where a secondary coagulating dose of alum is added. Following secondary flocculation, the water enters the older sedimentation basins, which are straight-through type with over and under baffles. Activated carbon, when needed, is added in the secondary flocculator. Recarbonation is accomplished in the secondary flash mixer by the use of flue gases from the steam pumping plant adjacent to the filtration plant.

The original plant was constructed with roughing filters, but when an increased plant capacity was required they were converted to standard sand filters. At the same time the Dorr clarifiers were added. By the addition of these units and the change from roughing to sand filters, the plant capacity was doubled.



The Topeka Plant—Fore and Aft
Filter Plant (Left) and Pumping Station (Right).

At times the raw water at this plant has a high turbidity of 13,000 p.p.m. or above. At such times it becomes difficult to soften, even though the hardness is no more than 150 p.p.m.

Sludge disposal from this plant is relatively simple. There is sufficient water flowing past the plant to dilute the sludge as it is returned to the river.

The distribution system in Topeka is operated as a "pressure system." There is no elevated storage, consequently the plant capacity has to be changed continuously to care for the needs from hour to hour. A 10,000,000 gallon ground storage reservoir is near the business section of the city. The pressure head of all the water entering this reservoir is dissipated through an hydraulic turbine directly connected to a booster pump. The hydraulic turbine passes to the reservoir about twice the quantity of water the booster removes. The electrically driven pumps draw upon this storage to care for hourly peaks in the business district. This reservoir also serves to modulate loadings on the treatment plant.

St. Louis County System

The St. Louis County Water Company serves water to 48,000 consumers to the west of St. Louis. It is a privately owned utility and uses water from the Missouri River. The service area, primarily residential in character, consists of the metropolitan area of St. Louis outside the incorporated limits. Through 780 miles of mains, service is supplied to 170 square miles of territory.

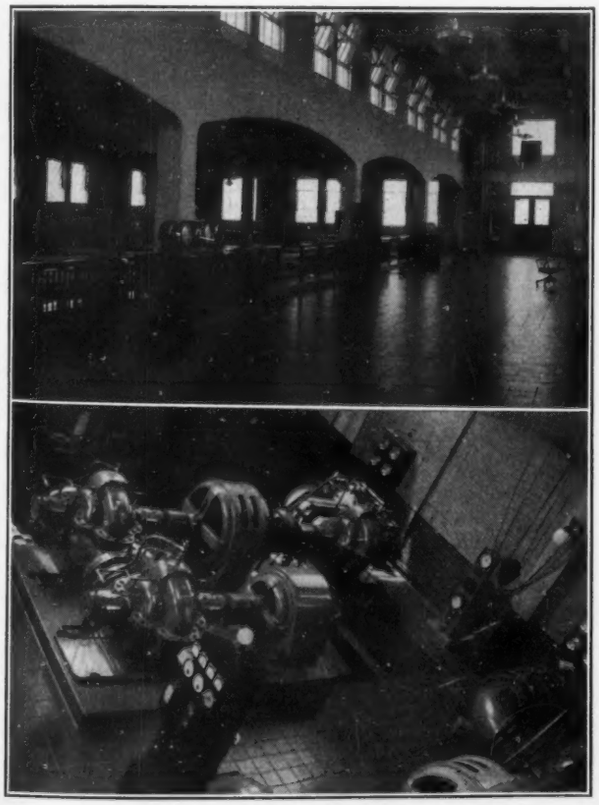
As is customary in the east, water rates are computed on a quarterly basis, and for a quarterly minimum of $3, 1,320 cubic feet of water per month are served. For the next 12,000 cubic feet the charge is 17c per 100 cubic feet, and for the next 50,000 cubic feet 15c per 100 cubic feet. There is a special night off-peak rate of 11c per 100 cubic feet for water used for sprinkling,

irrigation, or other uses. Large users can afford to draw into storage for subsequent day use at such attractive rates.

The hardness of the raw water varies from 175 to 250 p.p.m. and is softened to 100 p.p.m. using lime. Either alum or ferrous sulfate is used for primary coagulation, depending upon the character of the river water. Ammonium sulfate is fed to provide the ammonia component of the chloramine residual which is carried throughout the system. All chemical feed machines are in the basement of the chemical feed and laboratory building. Omega gravimetric feeders are used. There are five pressure feet chemical lines to five points in the plant, so that chemicals may be pumped to any one of five locations in the plant.

The mixing tanks are around-the-end type. (Mr. Weir, Superintendent and Chief Engineer of the Company, said he would never build another plant with such a type of mixer.) From the mixing chamber, water flows to three large open basins for sedimentation, and thence to a large open storage reservoir. From the reservoir water is pumped to the Dorr flocculators, which are immediately adjacent to the filter building. A secondary coagulant dose is fed to the suction line of the pumps which lift the water to the flocculators. This effects an excellent "quick mix." No sedimentation follows flocculation. Even with the period for storage in the large reservoirs of 1½ to 2½ days, the lime reaction is not completed. Recarbonation is not used because a depositing water is desired to keep the mains coated with carbonate scale. In addition maintenance of the recarbonation equipment proved to be an added expense.

The filters are constructed with Wheeler bottoms and



Plant of the St. Louis County Water Co. Operating Floor
(Above)—Operating Floor.
(Below)—Unique Arrangement of 3 Pumps in Series. For Reasons and Results See Text.

This Low Rakish Structure Is the New St. Louis County Company's Plant
The Key Note Was Design Economy Through the Use of Architectural Concrete and Brick.

their supporting structure was designed for an upthrust produced by a 56-inch rise of wash water when desired. This is a greater stress than one produced by sand, gravel, and water. A high filter rate of three gallons per square foot of filter area is used. These filters have been operated at times, experimentally, using approximately five gallons per square foot. This, of course, decreases the time between filter washes but does *not* increase the net percent. of wash water. In the filter gallery both cast iron and welded steel pipes are used.

The high lift pumping plant has an interesting combination of pumping units. There are two sets of three pumps in series (see accompanying picture). The first pump of each series operates at variable speed, the next two pumps operate at constant speed. With such a system it is possible to vary the rate of pumpage and meet the fluctuating demand on the distribution system. The reason for variation of pumpage is because there is only one distribution reservoir. This 12,000,000-gallon reservoir is several miles distant from the treatment and pumping plant.

The company owns its own transformer substation and power is purchased at 33,000 volts at the very reasonable rate of 6.8 mills per K.W.H.

Mahoning Valley District

Niles and Youngstown, Ohio, are served with water by the Mahoning Valley Sanitary District. Mr. Wm. I. Van Arnum is the chief chemist for the district and is in charge of the filtration plant. This plant, designed for 40,000,000 gallons, has an average production of about 14,000,000 gallons daily.

The raw water is impounded in a reservoir created by a dam just above the filtration plant. This reservoir has a peculiar history. About two years ago an aquatic plant developed in the upper reaches of the reservoir. This plant was identified by a biologist of the Ohio State University as being *nais flexus*. Its branches have the appearance of a Christmas tree twig. The plant grows to a height of approximately 3 to 4 inches but produces no odor or taste in the water, and it seems to create a biological balance in the water of the lake. The utmost flexibility of operation was provided for in the design and construction of this plant. By means of available conduits, the operator can use any combination of treatment tanks; thus he can provide for series, or parallel, operation of tanks, or for reversal of direction of flow. This ideal condition permits the operator to make any changes in flow to obtain any treatment process he desires.

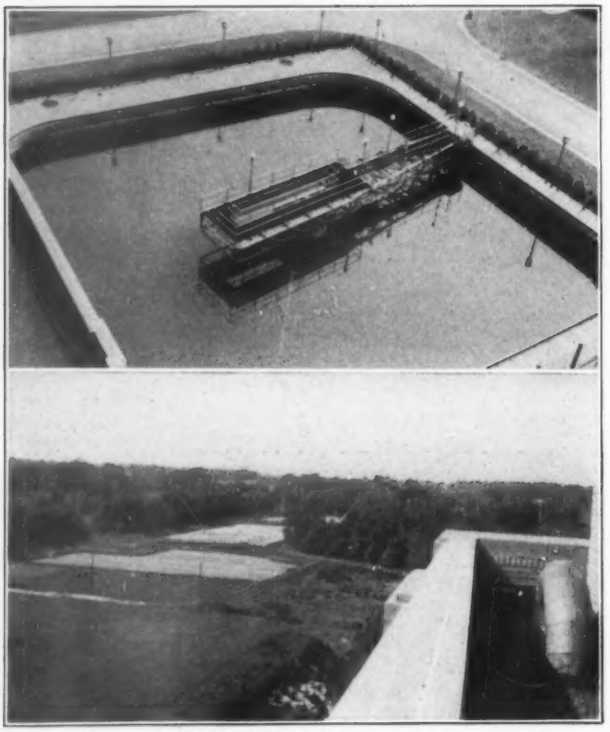
There are both inside (or covered) and outside clari-

fier basins; all are equipped with Dorr Co. mechanisms. Flow through the clarifier basins is from side to side (see cut). With an extremely long period for sedimentation available, resulting from operating the plant at such a low ratio to designed capacity, this method is quite satisfactory.

Lime and soda ash are bought in bulk and elevated to storage by pneumatic conveyors. Beneath the storage hoppers are the chemical feeders, whose discharges pass directly into the raw water conduits.

Sludge from the clarifiers is passed to large sludge basins near the plant. The plant has been operating for better than seven years, and the sludge basins have never yet been filled to capacity. The moisture content of two year old sludge in a basin seemed surprisingly high. This particular basin had a hard crust on the top about 2½ to 3 inches thick. Under this crust, the 2 feet or more of deposit contained a high percentage of moisture, which Mr. Van Arnum said was between 70 and 80 per cent.

Recently the sludge has been allowed to flow into the stream bed below the dam. There is considerable flow in the stream during spring and fall seasons, and it is anticipated that the sludge will be carried down stream during periods of high flow.

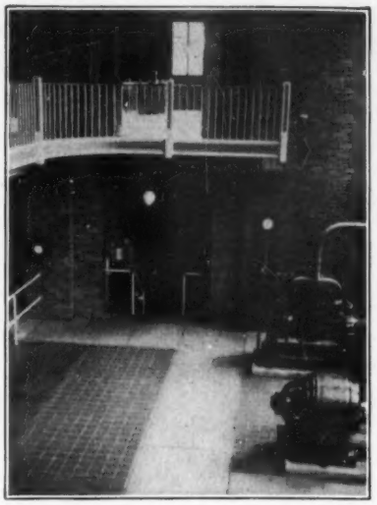


Plant of the Mahoning Valley Sanitary Dist.
One of the Clarifiers and the String of Sludge Lagoons. Sludge Disposal at Large Works Continues a Problem.

Bloomington, Ill.

Bloomington, Ill., has a water treatment plant situated on the banks of an impounding reservoir several miles north of the city. The view accompanying this article reveals the beauty of plant and its setting. The reservoir is created by an earth dam. The treatment plant is conventional in type, using split treatment, and is operated under Mr. Charles H. Spaulding's direction. Some disadvantages in the layout of the plant prevent getting the best of results, according to those responsible for operation.

Water is pumped from the impounding reservoir by



Pump Room at Bloomington, Ill.

low lift pumps to mixing chambers, where chemicals are added. Effluent from these mixing chambers is pumped to the sedimentation tanks. The sedimentation tanks are square basins and have Dorr clarifier mechanisms installed in them. Water enters on one side and flows across each basin to the effluent flume on the opposite side.

Due to precipitation of sludge in the influent and effluent channels there is considerable short circuiting of water through the basin. Thus the water enters the middle of the basin on one side, flows directly across the basin to the outlet of the effluent channel located at one corner. Mr. Spaulding considered installing precipitators in the mixing tanks and eliminating the sedimentation basins. However, the mixing tanks are rather on the small side to obtain a complete reaction. Recarbonation has been discontinued at this plant. The filter sand is permitted to accumulate a deposit of calcium carbonate. By permitting a deposit of calcium carbonate on the sand, recarbonation can be eliminated because there is a final reaction between these calcium-coated sand grains and the water which produces a certain amount of stabilization. As the sand grows, it is occasionally necessary to skim off some sand in order to keep the same depth of bed in the filters.

Sludge is ponded at Bloomington, as it is at Springfield, but the farmers in this vicinity do not use as much sludge as they do in the neighborhood of Springfield. As a consequence, sometime in the near future, more adequate sludge disposal will have to be provided.

Elgin, Ill.

Elgin, Ill., takes its water supply from wells drilled along the river bank. The underground gravels surrounding the wells act as a primary clarifier so that the water entering the plant is practically free from turbidity.

The treatment plant is conventional in type but poorly proportioned for the quantity and quality of water to be treated. The design and construction did not provide for any flexibility in operation. Thus, regardless of the quantity or quality of the water which is pumped, it must always pass through exactly the same treatment. This lack of flexibility has made it almost impossible to correct the inadequacies of treatment which developed when the plant was placed in operation.

The filters were constructed with porous plates for

The Elgin, Ill., Plant
Note the Central Control Table. This Plant Is an Example of Faulty Design.

underdrains. Due to faulty installation these plates, upon back-washing, broke loose from their anchorage. Due to faulty treatment there was some scaling up of the plates and the porous plates bottom has since been replaced with a Wagner underdrain system.

Sludge from filter wash and sedimentation tanks is concentrated in settling tanks at the plant. After the sludge is concentrated to about 65 or 70 per cent water, it is hauled in tank wagons to sludge beds about three miles distant. It is hoped that when the sludge in these beds dries out, the farmers will come and haul it away for fertilizer. If the farmers do not do this, it may become necessary to add a sprinkler arrangement to the tank wagons for spreading the sludge directly on the fields for the farmers.

Canal-Winchester, Ohio

Canal-Winchester, a small village in Ohio having a population of approximately 900 people, has an unusual water softening plant.

The water is produced from wells and has a total hardness of about 375 p.p.m. with 2.5 p.p.m. of iron. The iron is removed and the hardness is reduced to 70 p.p.m. Though there is a pronounced discoloration of the coke on the coke tray aerator, there is no evidence of an organic load such as would be evidenced in most iron waters of Southern California.

Immediately following aeration the water is dosed with lime and soda ash in a flash mixer. From the flash mixer, water flows through a Dorr flocculator into a sedimentation tank, which is around-the-end baffled type. At the end of the sedimentation basin is the recarbonation chamber, from which water flows directly to the sand filters.

This small but very compact plant is of a neat and pleasing appearance, and is located in a residential area.

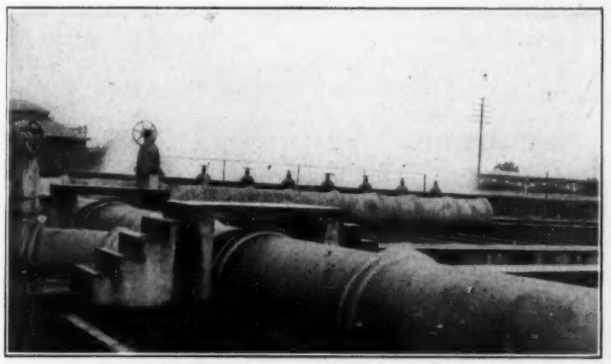
Sludge disposal at this plant presents a major problem. At the present time there are two sludge basins which are well filled. Attempts have been made to get the farmers to haul the sludge away as fertilizer, but the response has been disappointing. A tank wagon, equipped with a spreading device, similar to that used for oil spreading in road construction, has been purchased. The plan is to take the sludge from the sedimentation basin at the rate of about four tank loads per week, deliver and spread the liquid sludge for the farmer free of charge. What the net cost will be for this type of sludge disposal will prove interesting. For small to medium sized plants the scheme may work out very satisfactorily.

It's Not a Residence
But, the Neat and Well Operated Plant of Canal-Winchester, Ohio.

Fort Worth, Texas

Fort Worth, Texas, has a municipally owned water treatment plant with a capacity of 35 million gallons daily. Mr. W. S. Mahlie is the chemist in charge of this filtration plant. The source of water supply for Fort Worth is the Trinity River, upon which three impounding reservoirs, Lake Worth, Lake Eagle Mountain and Lake Bridgeport, have been constructed.

Lake Worth, immediately above the filtration plant, has become a popular resort area. Water from this reservoir has an average turbidity of about 25 p.p.m., an alkalinity of 130 p.p.m., a hardness which is all carbonate, and a pH of approximately 8. The water from Lake Worth is first aerated by spray nozzles of a type manufactured by the Spray Engineering Company, Hydrated lime, at the rates of 0.5 grains per gallon, and 0.7 grains per gallon of filter alum are then added to the water. Mixing and flocculation are accomplished in a combination of mechanical devices and baffled basins. The sedimentation basins are round-the-end baffled type basins, and are open to the weather. There are ten 2,000,000 gallon daily and twelve 1,250,000 gallon daily filters. The filters have cast iron underdrains surrounded and covered with 18 inches of gravel on top of which is 27 inches of sand.



The Aerators of Fort Worth
Interesting Is the Observation That Here Fine-Spray Aeration Seems to Effect a Small Reduction in Hardness.

Note—In Part 2 of this article the following plants are described and commented upon: Springfield, Woodstock and La Grange, Ill.; Williams Bay and Greendale, Wis.; Wheeling and Clarksburg, W. Va.; Lancaster, Ohio.

OHIO SEWAGE TREATMENT CONFERENCE

Reported by W. D. SHEETS,
Shift Supervisor,
SEWAGE TREATMENT WORKS, COLUMBUS, OHIO

For supplying this report we are greatly indebted to Mr. Sheets. However, we wish to explain in his behalf that his very complete report has had to be materially condensed.

To whatever extent this has detracted from the quality of the reporting, the editors of WATER WORKS AND SEWERAGE *take full responsibility.*

With this explanation, we ask that whatever deficiencies may be detected be laid to us and not to Mr. Sheets, who did a most commendable job of recording considerable more of the proceedings than could be used in the space available.—L. H. E.

W. D. Sheets

THE 14th Annual Ohio Conference on Sewage Treatment, held October 1st and 2nd in Columbus, Ohio, was attended by 142 members and guests.

The first order of the day was the appearance of Columbus' Mayor, the Hon. Floyd F. Green, who made the address of welcome.

Annual Dinner

The highlight of the Annual Dinner was the talk by Paul F. Lockett of the Research Laboratories, Owen-Corning Corporation, on "Fiberglas —the Everyday Miracle," accompanied by a "sound-slide" program and an extensive display of "Fiberglas" products ranging from air filters to fabrics developed for use on airplanes. The principal product is insulating material to be used in homes, ships, trailers and wherever insulation is desired.

F. H. Waring, Chief Engineer, and R. H. Markwith, M.D., Director of Health, of the Ohio State Department of Health, and Grover Clements, Service Director of the City of Columbus, spoke briefly.

Officers Elected

Officers chosen for the ensuing year are:

Chairman—Ben H. Barton, Chief Operator, Findlay, Ohio.
Vice-Chairman—A. H. Niles, Supt., Treatment, Toledo, Ohio.
Secretary—Bruce M. McDill, Ohio Dist. Health, Columbus, Ohio.
Treasurer—W. D. Sheets, Shift Supervisor, Columbus, Ohio.
Member of Executive Committee—R. F. Snyder, Sup't Treatment, Massillon, Ohio.

Technical Sessions

(Chairman F. E. Harroun Presiding.)

The first paper in the Technical Sessions constituted a discussion of **"Safety in Sewage Treatment"** by Ben H. Barton, Chief Operator, Sewage Treatment Plant, Findlay, Ohio.

Mr. Barton discussed the hazards existing in many sewage plants, stating that hazards usually spring from design, either from lack of experience, or from lack of funds.

Adequate safety features should be incorporated in all specifications for plant construction and means taken to insure no defeating their purpose by the operator installing a make-shift addition or change to expedite his routine.

"Rotary Distributors on Sand Filters" by H. A. Stepleton, H. P. Jones & Co., Consulting Sanitary Engineers, Toledo, Ohio.

Mr. Stepleton described the first installation of rotary distributors on sand filters at two sewage treatment plants near Lima, Ohio.

Past experience has proven that one-third to one-half of the surface area of the conventional type of intermittent sand filter carries the entire load of the applied sewage due to clogging and poor distribution. A self-propelled type of rotary dis-

tributor was selected for use in secondary treatment to overcome the above problems and likewise because of the economy of construction.

The filter is 36 feet in diameter with 24 inches of sand having an effective size of 0.3 to 0.45 mm. over graded gravel varying from 8 to 12 inches. The dosage rate used was 200,000 gallons per day in the filter design.

Following plain sedimentation the sewage discharges into a dosing tank having a capacity of 1080 gallons or an average of four dosings in 24 hours.

The plant has been operating satisfactorily with weekly rakings of the filter surface. Tests show from 95 to 98 per cent removal of B.O.D.

Comparative costs were:

Conventional type $3,000.00
Rotary distributor 1,740.00

"Experiences with Chlorine in the Control of Activated Sludge Bulking at Mansfield" by J. R. Turner, Supt. of Sewage Treatment, Mansfield, O.

Mr. Turner described the method of return sludge chlorination at Mansfield to control bulking in the activated sludge plant serving a population of 42,000.

The plant uses a combination of porous plates and mechanical paddles designed to operate on a .3 cu. ft. of air per gallon of sewage.

Sphoerotilus are ever present in the raw sewage and appear to be retained in the activated sludge where rapid multiplication takes place.

During 1938 chlorine was introduced into the return sludge and repeated experimentation revealed approximately 50 pounds of chlorine per day at a rate of 10 p.p.m., calculated on the volume of recirculated sludge, was needed to correct conditions causing the growth or to destroy the organism, as the case may be.

At times errors in judgment resulted in too small dosage with resultant sludge bulking, necessitating a rate increase to 20 p.p.m. until the bulking ceased. Then the control dosage was resumed at the average rate of 10 p.p.m.

Chlorine was also used to supplement air during a period when a blower was down for repairs.

"Recent Trends of Municipal Sewage Treatment in Ohio" by W. H. Knox, Asst. Engr., Ohio State Department of Health, Columbus, Ohio.

Mr. Knox reported that at the present time there are 186 sewage treatment plants in 54 cities and 125 villages in Ohio. Since 1934, entirely new plants have been built at 28 cities and 79 villages, and important improvements or additions have been made to plants at 7 cities and 10 villages.

Mr. Knox cited the 6-year period from 1934 to 1940 as by far the most important era of sewage treatment in Ohio.

In the listing of types of plants and processes installed since 1934 Mr. Knox's paper revealed: Chemical Precipitation, 16 plants; Trickling Filters, 39 plants; Activated Sludge, 14 plants; Chlorination, 27 plants (23 of which employ pre-chlorination for one or another reason); Effluent Straining Filters at 4 plants; Screenings Comminutors at 14 plants; Gas Engines at 11 plants (more to have engines shortly).

The No. 1 filter had an average rate of 1.61 m.g. per acre per day and the effluent averaged 209 p.p.m. of suspended solids and 290 p.p.m of B.O.D. The intermediate settling tank gave an effluent averaging 146 p.p.m of suspended solids, and 256 p.p.m. of B.O.D. going to No. 2 filter.

The No. 2 filter effluent ran 122 p.p.m. of suspended solids and 45 p.p.m. of B.O.D. While the final settling tank effluent averaged 67 p.p.m. of suspended solids and 31 p.p.m. of B.O.D.

Mr. Tolman listed the following conclusions, based on the past operation:

1. Strong brewery wastes can be satisfactorily oxidized by trickling filters operated in series.
2. With rates of application of 10 pounds of 24 hour B.O.D. per 1,000 cu. ft. of stone 95 per cent removal of 24 hours B.O.D. may be expected.
3. Operation of filters causes no unusual problems.
4. Filter flies can be controlled by applying 40 p.p.m. of chlorine to the flow going to the primary filter.
5. Brewery waste sludge can be satisfactorily digested.

[Mr. Tolman might have added the pertinent observation that supernatant liquor created no problem in the functioning of the trickling filters, although this liquor did not have the benefit of stage digestion. —Ed.]

"Routine Sampling and Analysis in Ohio Sewage Treatment Plants" by L. T. Hagerty, Chief Operator, Sewage Treatment Plant, Bedford, Ohio.

Mr. Hagerty discussed the variations in sampling and testing methods as used in 50 plants to which questionnaires were mailed. Of the 50 plants no two took samples at the same interval, or the same number of times per day.

Typical of these variations are the 12 plants of 5 m.g.d. or over, which reported methods of running D.O., 2 used the Winkler Method, 6 used

the Rideal Stewart and 4 used the Sodium Azide Method.

Mr. Hagerty stressed the need of greater standardization in routine sampling and analytical procedure.

Treating Brewery Wastes

"Operation of the Waste Treatment Plant of the Gulf Brewing Company, Houston, Texas," by S. L. Tolman, Manager, Sanitary Engineering Division, Jeffrey Mfg. Company, Columbus, Ohio.

Mr. Tolman reported upon the operation of the Gulf Brewing Co.'s plant treating brewery wastes.

The plant consists of two 2-speed centrifugal pumps, two settling tanks equipped with sludge collecting equipment and syphons for discharging to the filters, two trickling filters serving in series and equipped with rotary distributors; a final settling tank, with sludge collecting equipment; a sludge digestion tank; sludge drying beds, and a laboratory building located on top of the primary and secondary tanks.

Normal operation of the plant is as follows:

The untreated waste flows by gravity to a wet well where a centrifugal pump lifts it to the primary settling tanks. The effluent passes to a dosing tank built at the end of the settling tank and is discharged onto the No. 1 filter by an automatic syphon. The filter underflow passes to a centrifugal pump which lifts it to the second settling tank; from which the effluent passes to a dosing tank and then onto the No. 2 filter. The effluent from this filter flows by gravity to the third settling tank from which the effluent is discharged into a bayou.

All settling tanks are equipped with conveyor type sludge removal mechanisms, which are operated continuously. Sludge is withdrawn twice daily, 0.80 per cent solids being pumped into the digester. The supernatant is returned to the head of the plant and has caused no trouble in filter operation. Sludge beds are filled three or four times a month, the dried sludge being given away.

The following averages show the results of operation for the year 1939 and to August, 1940.

The raw liquor averaged 411 p.p.m. of suspended solids with a 5-day B.O.D. of 850 p.p.m. The primary settling tank effluent averaged 260 p.p.m. of suspended solids and 694 p.p.m of B.O.D.

"Effect of Milk Wastes on Sewage Treatment at Marysville" by E. S. Wittmer, Engineer with Floyd G. Browne & Associates, Marion, Ohio.

Mr. Wittmer discussed the results of a comprehensive study on the treatment of milk wastes entering the Marysville plant.

The plant was designed originally to treat 480,000 g.p.d. but was rebuilt to handle the milk waste load which gave a maximum population equivalent of 29,000 with a minimum of 12,000.

Results of plant operation gave an overall reduction of B.O.D. of 96.6 per cent. Filters equipped with rotary distributors were operated in series on the settled sewage to give two stage filtration. This was followed by sand filters.

The 5 day B.O.D. through the plant was as follows:

	p.p.m.
Raw Sewage	580
Settled Sewage	439
Filter A (first stage)	142
Filter B (second stage)	56
Final Effluent	20

"Estimation of Water Used for Cooling at Lima, Ohio," by E. E. Smith, Supt., Department of Water and Sewage Treatment, Lima, Ohio.

Mr. Smith reported on a study of increased water consumption and sewage flow attributed to increasing use of water in residential and commercial air cooling. Graphs displayed revealed the effect of high air temperatures in increased flows of sewage; this, in contrast with the usual observation that flow decreases with hot dry weather.

Sludge Disposal

"Sludge Filtration and Incineration at Cleveland" by G. E. Flower, Supt., Southerly Sewage Treatment Plant, Cleveland, Ohio.

Mr. Flower discussed the following items based on experience gained in vacuum filtration at Cleveland.

The cloths now used are of cotton, in preference to wool or fine mesh woven wire which have also been tried.

The screens supporting the filter media became badly clogged with carbonate deposits from the filtrate. Cleaning method developed consisted in coating an unused filter cloth with rubber latex, suspending this cloth under the entire filter drum and filling the bag formed with muriatic acid so that bottom section was submerged. This scheme enabled the operators to clean the filter in four hours' time.

The same deposit formed in the filtrate lines, causing installation of a new and shorter line to a lagoon within the plant.

It has been found that as the sludge solids increased the $FeCl_3$ and CaO consumption decreased. It was also found that as the sludge solids increased the solids also increased in the filter cake. Likewise, the rate of filtration increases directly as the sludge solids increase.

Mr. Flower concluded that if the solids content of the digested sludge is increased, the following benefits will generally result:

1. Smaller volumes of sludge and vacuum filtrate to handle.
2. Savings in conditioning chemicals.
3. Greater filter yields.
4. Increased life of filter cloths due to decreased amounts of lime.
5. Less frequent cleanings of lime deposits from screens supporting the filter cloths on the vacuum filters and in the piping handling the filtrate.

Mr. Flower also gave considerable cost data for 1939 on both the Westerly and Southerly Treatment Plants of Cleveland. Based on dry solids in sludge filter cake, costs of $5.97 and $4.92 per ton of dry solids were noted for the Westerly and Southerly Plants respectively. Incineration costs on the same basis were $5.10 and $3.86, respectively, for the same period.

Difficulties in incineration have decreased due to manufacturers' assistance and increased experience of operators.

"Military Sanitation and the Sanitary Corps" by W. A. Hardenbergh, Vice-president, "Public Works Magazine," New York, N. Y.

W. A. Hardenbergh, now the commanding officer of the Sanitary Corps, defined the duties of this Corps with relation to the army. It is essentially a technical staff of specialists, including sanitary engineers, sanitarians, chemists, bacteriologists, food and nutrition specialists, milk, food and meat inspectors, entomologists, vital statisticians and many others.

The Sanitary Corps, composed entirely of reserve officers, having ratings from 1st Lieutenant to Colonel, forms one of the seven components of the Medical Department. In discussing its future, Col. Hardenbergh stated that the Sanitary Corps will be utilized as it would be in the case of war. There will be considerable work involved in the development of new bases, new centers or enlargement of the present facilities.

Although at the present time no appointments are being made, it is possible that such appointments

would be made in the future. Any person interested in a commission in the Corps should write to the Surgeon of the Corps Area in which they reside.

Prize Operator Papers

An innovation this year in the Ohio Conference was the selection of the two most meritorious papers presented during the year before the four sectional organizations of sewage works operators in the state. These four operator associations, now boasting a total membership of 203, hold a number of interim meetings during the year, thus serving a highly beneficial purpose.

Of the papers presented before these sectional meetings during the year each group selected two papers for entry in the prize contest. From the eight entries a committee selected the papers deserving first and second awards.

The winners were:

W. B. Nagel, Plant Operator, Dayton, Ohio—First Award for his paper—"The Autobiography of a Sewage Treatment Plant"—a rather unusual and interesting unfolding of revelations and reminiscences of a sewage treatment plant with a life of vicissitudes and good-times under three operator regimes, and how the plant felt toward each.

W. F. Crohen, Plant Operator, Findlay, Ohio—Second Award for his paper—"The Calendar and the Clock Have Much to Do With Sampling Results"—analyzing the findings of a planned study of sampling methods, revealing considerations which must be given hourly, day to day and seasonal variations in deriving sampling schedules if the analytical results are to turn out a fair picture of sewage quality and plant performance. Amongst conclusions reached there appeared to be no such thing as a representative single catch sample at any time for plants of small to medium size.

Both of these papers are to be published in the 1941 Proceedings of the Ohio Conference.

Group Discussions

On Tuesday afternoon the annual group discussions were held with the reports of the group leaders being given at breakfast on Wednesday morning.

Group I: *Maintenance of Sewage Works* by Earl Hoover, Chief Mechanic, Sewage Treatment Plant, Findlay, Ohio, reported the discussion of various plant troubles and their solution. The possibility of adopting complete records to maintenance work was discussed. The conclusion reached was that some general plan that could be applied to all plants would be valuable.

Group II: *Activated Sludge Treatment* by W. H. Jacobs, Operator, Sewage Treatment Plant, Lima, Ohio, reported discussions on the control of the chironimid fly, noted in both water and sewage plants in Ohio in 1940; also the proper concentration of solids in aeration tanks and effect of excess agitation on the activated sludge.

Group III: *Sewage Filtration* by G. Albro Hall, Floyd G. Browne & Associates, Marion, Ohio, reported discussions on fly control methods, by chemicals or flooding. Col. W. A. Hardenbergh described a biofiltration plant at Liberty, New York, with unusual features.

Group IV: *Sludge Treatment and Disposal* by J. H. Wenger, Sewage Treatment Plant, Westerville, Ohio, reported discussions on digestion tank temperatures and supernatant difficulties followed by mechanical filtration.

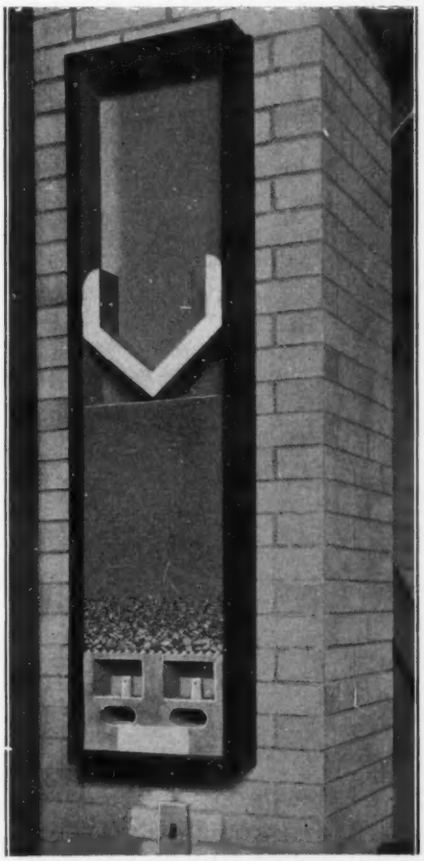
CONCRETE DUPLEX FILTER BOTTOMS AT LEAVENWORTH, KAN.

By J. P. MYRON*

The city of Leavenworth, Kansas, has recently completed its new Filter Plant which has a capacity of 4,000,000 gallons per day. There are four filter units, each 18 feet wide by 20 feet long, with a cross gutter wall at the front end of each.

For the under-drain systems the engineers selected the Concrete Duplex Under-drain System. With this system it was only necessary to provide a total depth of 8 inches of small gravel and a total depth of twenty-four inches of filter sand, as pictured in the accompanying sectional view.

A special feature of these filters is that a center flume 3 feet wide by 2 feet 6 inches high running full length of the filter was provided. The wash water under pressure enters this flume and the effluent is taken from this flume when filtering. All of the laterals connect to this flume which tends to distribute the wash water evenly over the entire bed. This center flume has a distinct advantage in that a man may enter it through a manhole casting at the front of the filter so that a complete inspection of the laterals of the under-drain system may be made at any time desired. Furthermore, if it were ever necessary the laterals could be thoroughly cleaned from this center flume.



Section Through Filter Bed and Duplex Under-drain System.

Concrete laterals, porcelain nozzles, perforated concrete secondary distributing blocks.

Another feature of the Leavenworth filters is that when filtering at the rate of one million gallons per day, which is the normal rate of one of the filters the loss-of-head through the under-drain system is only ¾ of one inch. And when washing at the rate of 22 gallons per square foot per minute (36 inches vertical rise) the loss-of-head is only 6 feet 8 inches. These ratings being taken on a water column. This is considered a remarkable performance and readily permits a higher rate of filtration at times when needed. Furthermore, it makes the expense less in providing wash water facilities. The cost of this improved concrete underdrain system was practically the same as a well designed pipe underdrain system would have been.

This plant has been in operation since January, 1939, and is giving excellent results. It was designed by Black & Veatch of Kansas City, Missouri. E. W. Bacharach & Co., of Kansas City, were the filtration contractors; and the writer's firm designed and furnished component parts of the under-drain system.

*Chief Engineer, F. B. Leopold Co., Inc., Pittsburgh, Pa.

KY.-TENN. SECTION RETURNS TO LEXINGTON

A City of Thoroughbreds, Where the Horse Is King

THE 1936 meeting of the Kentucky-Tennessee Section of A.W.W.A. in Lexington left nothing to be desired. So, this Section returned to this "City of Thoroughbreds" for a three day meeting on Oct. 21-23rd, which was concluded with a tour of some of America's finest stables, of which the countryside around Lexington boasts many.

An impressive and satisfying part of this meeting was the program arrangement which scheduled no more than three papers to the session, allowing comfortable time for discussion with enjoyable results.

Chairmen

(Retiring)
H. N. Jernigan, Wallace & Tiernan Co., Lexington, Ky.

(Incoming)
H. C. Bristol, Supt. of Water, Alcoa, Tenn.

During the meeting time was found for a visit to the recently revamped and enlarged filter plant and pumping station of the Lexington Water Company, now named in honor of the long time Chief Engineer and Manager of the Lexington plant, the late Wm. S. Cramer, a past-president of A.W.W.A.

The Fuller Award

To Howard D. Schmidt, secretary of the section, was voted the George W. Fuller Award in recognition of his work in connection with the Tennessee Operators' Short School, and his "wheel-horse" work in the section before and since becoming its secretary.

Entertainment—

The gala event of the Convention was the dinner dance held out at the Lexington Country Club where nobody of any consequence orders up anything but "whisky," and that means only one thing—good old "Kaintucky" Bourbon.

The most interesting entertainment feature was a tour of Lexington's famed stables of thoroughbreds, where an opportunity was had to see the No. 1 horse of all time —"Man of War"—a real Lexington product as was his "mamma and papa." Of course, there were many other famous horses in the stables visited but none possessing the records or the box-office value of the great "Man of War."

Officers

The following were named officers for the ensuing year:

Chairman

H. C. Bristol, Supt. of Water, Alcoa, Tenn.

Vice-Chairman

R. R. Harris, Asst. Engr., Ky. State Dep't. of Health.

Secretary-Treasurer

Howard D. Schmidt, Chief Engr., Tenn. State Dep't. of Health.

Trustees

John J. Quinn (Knoxville).

Clark Cramer (Lexington).

E. E. Jacobson, continued as A.W.W.A. Director representing the section.

Nashville was chosen as the place of the 1941 Convention.

Technical Sessions

(Chairman H. N. Jernigan presiding.)

"The Protection of Water Works Properties Against Sabotage" by F. C. Dugan, Director of Sanitary Engineering, Ky. State Dep't. of Health, Louisville, Ky.

Mr. Dugan directed attention to the timely article in the July 20th issue of "Engineering News-Record," dealing with water supply protection against emergency failures and possible sabotage. On this article much of his talk was based, covering in brief the following suggestions.

It is wisdom during the emergency to limit plant visiting to those holding a permit. (It was noted that this requirement was already in force when the day following members were required to have a permit when visiting the Lexington Water Co. plant.—Ed.) Further if any spurious visitor is found, to follow up by reporting the matter to the nearest F.B.I. agent if there be any suspicions as to the caller's true intent or identity. It was also a wise precaution to check through all employees.

In regard to safeguarding the structures, the following—

(1) Provisions of adequate lighting of plants, intakes and dams.

(2) Duplicate telephone lines or availability of radio communication.

Host and Secretary

E. E. Jacobson, Mgr., Lexington Water Co., Lexington, Ky. (A.W.W.A. Director)

Howard D. Schmidt, State Sanitary Engr., Nashville, Tenn. (Secy.-Treas.)

(3) Prohibit parking of cars near dams and prohibit fishing and other recreational use of reservoirs.

(4) Provide ample valving for sectionalizing main supply lines and distribution systems.

(5) Carry to completion betterments already planned, as system strengthening improvements without further delay.

(6) Maintain adequate reserves of supplies—chemicals in particular.

Mr. Dugan closed by telling of a plant visitor, posing as a salesman, who asked to be given a plan of the local purification plant. This visitor's true mission still remained unsolved. Therefore, "On Guard" should be the present maxim of all water works employees. While the F.B.I. does not offer direct assistance, the specific advice of this agency is well worth securing, was Mr. Dugan's closing suggestion.

L. S. Vance, Chief Engineer, Louisville (Ky.) Water Co. (a municipally owned property) in discussion,

suggested that visiting permits be highly restricted; that a most important consideration was that employed personnel be carefully checked to cover considerable of the individual's history (especially his schooling, his relatives, societies, and past military service records); also, look at the plant and properties from a distance in considering hypothetical damages to points most vulnerable; plan and record what is to be done in this and that case, so that action may be promptly and effectively taken if needed.

E. E. Jacobson, Manager, Lexington Water Co., indicated that local citizens feel more secure if they know that the water utility has instituted preventative and protective measures to safeguard the local water and electric utilities. With this in mind the Lexington plant had been fenced and flood-lighted, and visiting permits greatly restricted. There was some doubt concerning the value of emergency patrols, the most valuable and certain protection being the loyalty and conscientiousness of employees.

Linn H. Enslow, Editor, "Water Works & Sewerage," questioned the value of special patrols or so-called "guards." In saying this he rather went on earlier experiences. In Canada guards had been dispensed with and more fencing and lighting provided at less cost and with more dependability. His own experience with a guard of "doughboys" during the last World War at the Spartanburg, S. C., plant had convinced him of the false security involved, disregarding the expense and nuisance. Mr. Enslow added one suggestion credited to N. J. Howard, President of A.W.W.A.—and a very worthy one —namely, that two or more copies be made from all plans and records, for use in an emergency; that complete sets of these be safely stored at secret points, as a measure against possible complete loss or damage to plans now on hand.

W. W. Brush, Editor, "Water Works Engineering," said that New York City was limiting the areas for recreational use on its vast watersheds. It seemed the consensus of opinion that special guards were not of any appreciable value. The principal items to look to were those of adequate equipment reserve and facilities for making emergency repairs.

E. L. Filby of Black and Veatch, Engrs., Kansas City, Mo., directed attention to the growing practice of equipping service and repair trucks (water and sewage) with radio receiving sets, such being tuned to receive orders or instructions through the police radio system—a highly useful system in any emergency.

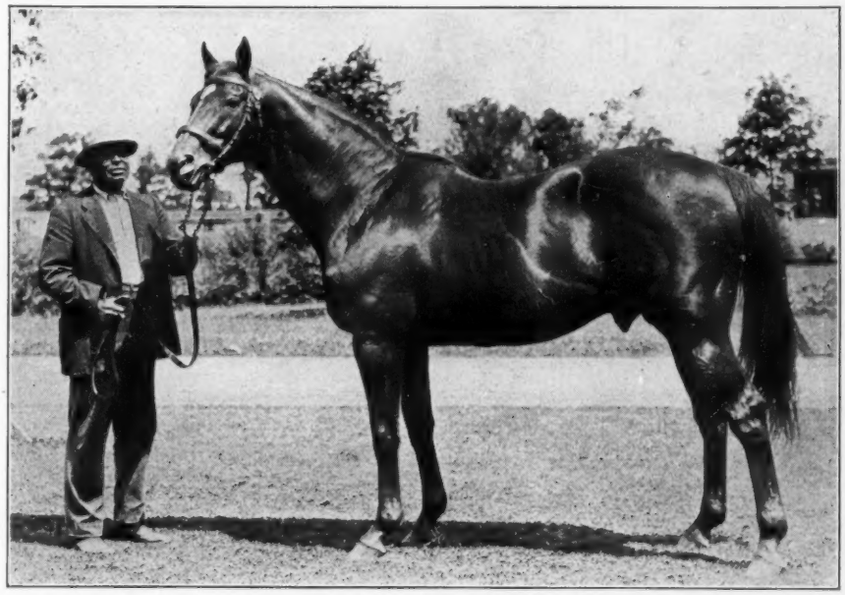
"Rating of Public Water Supplies" by R. P. Farrell, Ass't Director, Div. of Sanitary Engineering, Tenn. State Dep't. of Health, Nashville, Tenn.

Mr. Farrell reviewed the very interesting rating schedule developed by the Tenn. Department of Health in an attempt to give public water supplies of Tennessee a fair rating, which will prove truly comparative. The development of such a schedule, as may be imagined, has entailed lengthy consideration of the numerous elements and factors to be considered in a truly representative rating of water supply quality, quantity and dependability. One matter delaying completion of the provisional schedule, as it now is considered by the Department, has been the Operator Certification Plan now in effect in Tennessee. While the system comprises voluntary certification only the fact that a certified operator is employed carries a considerable and justifiable weight in the Tennessee rating schedule.

(We wish to comment here that the schedule as it now stands is to our mind one deserving a deal of consideration, as representing the most carefully studied and thoroughly grounded schedule of its kind of which we have any knowledge. The Department's engineers deserve high commendation for the study that has been devoted to this production, which admittedly will be further perfected as the result of experience with its adaptability to many conditions. May we, therefore, heartily recommend the results of a most difficult undertaking—but one which we believe can be made to serve a highly effective purpose in advancing water supply practice.—Ed.)

To date in Tennessee 89 operators have applied for certification under the voluntary scheme. In the rating schedule there are 3 major items which are further subdivided and weighted as to credit points—namely, (1) Physical equipment and plant condition—42 pts.; (2) Operation and Operator qualifications—38 pts.; (3) Water quality records—20 pts. A perfect score is 100 points.

We regret that space limitations prevents the effective breaking-down of the 3 major items into the 16 component parts. Of particular interest, however, is the fact that no treatment plant will receive a rating until provided with dependable equipment necessary in producing a safe supply, in duplicate. The supply sources (quality and quantity) rates 10 points of the 100; a certified operator rates 9 points, for adequate laboratory facilities an additional 10 points; satisfactory general appearance and cleanliness of plant gives another 5 points; the existence of dangerous cross connections results in a penalty, if not completely precluding a rating of any kind; the local manager is required to make inspection and file proof of elimina-



What Water Is to the Desert the Horse Is to Lexington

Here is the World's Greatest. A native-son is "Man-of-War," now in his 24th year, and still worshipped. His record, of having won every race entered, stands as one that can never be beaten.

tion of all hazardous cross-connections; satisfactory physical, chemical and bacterial quality records constitute 20 points, 10 points being for bacterial quality; a further qualifying requirement for eligibility to a rating is that the supply in question go to not less than 75 per cent of the population of the community served.

To emphasize conditions which prohibit ratings of any sort we recapitulate—(1) The supply shall serve no less than 75 per cent of the population of the community; (2) Bacterial quality records must equal or better the prevailing standards of the U. S. Treasury Department—i.e., the U. S. Public Health Service requirements for waters served interstate travelers on common carriers, as determined by not less than 10 monthly samples examined by the State Depatment of Health; (3) There shall exist no unapproved cross-connections between the public supply and other supplies.

As a trial balloon preliminary surveys have been made and letters of recommendation written every mayor and water superintendent in the state. To date only 12 supplies in the State have been approved for final rating. Strangely enough, stated Mr. Farrell, the plant cleanliness requirement had proved the greatest single point of contention. Frequent conferences of the Department's inspecting engineers had been arranged in order to enhance uniformity in ratings.

Harry E. Jordan, Executive Sec'y. of A.W.W.A., reciting an experience in rating, considered a Sanitary Quality Rating Schedule just as legitimate and as worthy as Fire Rating Schedules. He expressed some surprise at the lack of requirements of systematic laboratory checking in rating the so-called safe supplies which assumedly receive no treatment but which have been known to go bad. He also felt that cautious consideration should be given the handling matter of cross-connections. It seemed that the rating schedule, or set up, rather put the local water manager on the spot, in

Programmers
J. Steven Watkins, Consulting Engineer, Lexington, Ky.
C. E. Trowbridge, Chief Chemist, Am. Water Wks. and Elec. Co., New York.
Elwood Farra, Engineer, Lexington Water Co.

holding him responsible for complete cross-connection eradication—or else. (The "or else" is our construed thought rather than words of Mr. Jordan.—Ed.) He did state that the matter of cross-connections seemed somewhat overemphasized, without a clearer understanding of the provisions than he was able to secure in the listening.

Oscar King, City Engineer, Kingsport, Tenn., reported splendid cooperation from Kingsport's industries in rendering cross-connections safe.

H. C. Bristol, Sup't. of Water, Alcoa, Tenn., believed that cross-connections could be handled satisfactorily in Alcoa.

Linn H. Enslow stated, from some experience, that Kingsport (and likely Alcoa) could boast real "Christians," but that condition was far from being the general rule. To him it was somewhat difficult to understand why the double check valve system (approved type F.M. valves with systematic check inspections) was not an acceptable protection. Their records in carefully surveyed Connecticut had certainly proved their dependability. Therefore, in lieu of the feasibility of physically severing industrial connections, the double check system deserved due consideration in his opinion. As to the matter of holding the water manager responsible, and not recognizing approved double check valve connections, possibly the pendulum was swinging too far as a matter of practical consideration.

Since, aside from this matter, Tennessee's Rating Schedule had so much to commend it, it could be revised and strengthened as experience dictated. If considered as a "provisional" schedule in the first year or two of application, justified changes could readily be made and nobody would be hurt in the doing. Tennessee had already felt the value of the Rating Schedule during its "testing period" and with cautious feeling of the way a splendid job in the end seemed in the making. It appeared definitely superior to anything similar so far attempted.

Howard D. Schmidt, Chief Engr., Tenn. Dep't. of Health, in closing the discussion, stated that it was the intent of the Department to conduct the rating program on a cooperative basis until completely satisfied as to its workability. He displayed an "Approved Water Supply" highway sign only recently being given cities for highway entrances to the municipality. The first requirement for one of these signs is sufficient

(1) *The Revamped and Enlarged Filter Plant of the Lexington Water Co.;* (2) *H. E. Jordan, Exec. Secy. A.W.W.A., E. L. Filby of Black and Veatch Engrs., Kansas City;* (3) *Bronze Plaque to the Memory of W. S. Cramer* (1867-1933) *former Chief Engr. and Manager of the Lexington Water Co., which he served for 46 years. Mr. Cramer was a Past-President of A.W.W.A.*

(1) *Mr. and Mrs. Robt. R. Harris of Louisville—Mr. Harris is Asst. State Sanitary Engr.;* (2) *Larry Lingnor, Tie Boy and Mrs. Larry enjoy the tour of the stables and seeing some real horse flesh—Mr. Lingnor sells advertising in* WATER WORKS AND SEWERAGE; (3) *One of the twin Cascade Aerators at the Lexington Filter Plant. In the foreground is one of the Dorr Flocculators covered at this season of the year with a dense vegetative scum blanket.* (4) *Mr. and Mrs. A. I. Andrews, of Cincinnati, out at the stables. Mr. A. gave the section some "break-pointers" in chlorination.* (5) *"Mrs. Secretary" and "Madam President," the better halves of Secy. Schmidt and Chairman Jernigan.*

dependability of methods, equipment, and management to warrant the responsibility to the public that is taken on by the Department in giving out such signs, which are more easily issued than recalled.

(The considerable space allotted this topic has been given on the score of its seeming importance to advancing good-operation and bringing public recognition to good management in water supply practice generally. We know of no method more practical in such attainment, and generally understandable, than a sound workable Sanitary Rating Schedule widely applied.—Ed.)

"Small Diameter Cast Iron Pipes" by *B. F. Crabbe,* McWane Cast Iron Pipe Co., Birmingham, Ala.

Mr. Crabbe directed attention to the very satisfactory history of 2 inch cast iron pipes in water supply service, revealing that the annual production of this small diameter pipe had grown from less than 50,000 feet in 1922 to 5,000,000 feet in 1939. The refinements in metallography, the casting, and straight line production of 9 ft. lengths (as compared to the earlier 5 ft. lengths), and tapping collars, added considerably to the merits of 2 in. pipes of long lived cast iron for adaptation where pipes of much less longevity had been earlier employed. Another advance in design and manufacture had been the Precaulked Lead Joint, to facilitate laying without joint pouring, and also the threaded joint. The Glantite Rubber Gasket Joint had been perfected to increase flexibility where necessary, and also to serve as an expansion joint.

Programmers

Jas. H. Fry, Supt. Filtration, Nashville, Tenn.

F. Clark Dugan, Chief Engr. Ky. Dept. of Health, Louisville.

A. I. Andrews, Chemist, Wallace & Tiernan Co., Cincinnati.

C. M. McCord, Director, Water Dept. of Memphis. (Past-Chmn.)

Robt. R. Harris, Engr., Ky. Dept. of Health. (Newly Elected Vice-Chmn.)

Mr. Crabbe also pointed out that 2 in. cast iron pipes with cement linings are now available for systems handling the more corrosive waters. Further, two 9 foot sections are screwed together, tested at the foundry for air tight jointing, and shipped as 18 foot lengths to further simplify handling and installation. Among the most important uses of these pipes are duplicate mains, services, extensions, and for interconnecting larger mains in distribution systems (grid-ironing), as filter underdrains, for golf course sprinkling systems, and heating coils and other piping at sewage plants, etc.

In the ensuing discussion, all users seemed well satisfied with Mr. Crabbe's pipe and it was brought out that 2 in. cast-iron is considerably less costly than 2 in. copper tubing plus the difficulty of handling such large diameter tubing. In tapping 2 in. cast-iron pipes a 1 in. tap is the largest considered practical. In the Memphis system, C. M. McCord stated that copper tubing was employed up to 1 in. size only; for 2 inch lines and services precaulked cast-iron is employed.

"Maintaining Water Service in Sub-Zero Weather" by *Elwood Farra,* Ass't. Sup't., Lexington Water Co., Lexington, Ky.

Mr. Farra related some real operating difficulties on the Lexington distribution system, designed for Kentucky weather which had swapped places with New England weather last winter. The net result was 50 continuous days under freezing, 292 services and better than 1300 meters frozen—600 of the latter to an extent necessitating major repairs. In consequence, 15,000 to 20,000 consumers were without water; a fleet of 15 trucks operating day and night; water delivered in 5 gal. cans without charge to homes out of water; hydrant thawing by pouring concentrated sulphuric acid into the barrel, resulting in spontaneous heat, flushing thereafter and filling with alcohol-water.

Mr. Farra told of a method developed to spring ice-distorted meter cases back into perfect shape. A steel reshaping die was made and a 25 ton hydraulic jack did the forcing job in a few seconds, less powerful jacks having proved inadequate.

In reply to a question, Mr. Farra explained the simplicity of the acid method of thawing which has been employed successfully for some time in Lexington. The method is described in full in the 1939 Reference and Data Issue of "Water Works and Sewerage." The only equipment consists of a pint bottle (rubber stopper) of concentrated H_2SO_4. The stopper is removed and full contents of bottle poured into the hydrant

Ray Erion, Milford, Ohio. (For 26 years Supt. of Water.)

Wm. H. Johnson, Supt. of Water, Harrodsburg, Ky.

R. P. Farrell, Asst. Engineer, Tenn. Dept. of Health, Nashville.

(1) *E. E. Jacobson (Lexington) and Ben. Crabbe, McWane C. I. Pipe Co., Birmingham, Ala.;* (2) *Larry Lingnor,* WATER WORKS AND SEWERAGE, *Chicago, and Paul Miller, Matheson Alkali Wks., Cincinnati;* (3) *Strother Branson, Supt. Light and Water, and J. W. McCoy, Supt. Filtration, Madisonville, Ky;* (4) *Clark Cramer (son of Wm. S.) Plant Supt., Lexington Water Co., and John Quinn, Supt. Filtration, Knoxville, Tenn.;* (5) *"Jerry" Kavanagh, Distr. Mgr., Wallace and Tiernan Co., Knoxville, Tenn., and "Steve" Watkins, Consulting Engr., Lexington.*

through the hose or steamer connection. In a few minutes a heat-hole is drilled through the ice cake and water begins to flow, and the acid thus flushed out. So useful, quick and simple is the method that every Lexington fire truck carries two bottles of the acid at all times during winter months.

So hard put was the Company with its own service thawing (electrical method) that equipment could not be spared for thawing consumer services. To preclude refreezing (many services did, however), consumers were advised to let water run constantly—result, double the average winter pumpage.

L. H. Enslow told of a method of thawing hydrants by piping the hot exhaust gases from an automobile or truck into the hydrant—a flexible metal hose being used as the conductor. The method was thought to have been conceived by Sup't. Griffiths of the New Kensington (Pa.) Water company. For protection of exposed pipes and leaky hydrants, a heating tape such as is employed in greenhouse soil beds had been employed by twining the tape around the pipe or hydrant, and employing a covering of some sort to hold the heat in. It was really surprising, commented Mr. Enslow, to see what a minor quantity of heat is required to *prevent* freezing, as compared to the large amount of heat input for thawing after freezing.

"Electric Power in Water Pumping" by *F. I. Fairman*, Kentucky Utilities Co., Lexington, Ky.

Mr. Fairman presented what may be termed a "sales-talk" on the advantages of motor driven pumps in this day of dependability of current source through hook-ups of large interlocking electric utility systems. He related the advantages and economy of automatic pump operations and cited cases of such performance at small plants. He also related cases wherein the testing of centrifugal pump efficiency had resulted in purchase of units of higher efficiency, the marked savings in power resulting in writing off of the expenditure in less than two years.

(1) C. H. Franklin, Supt. of Water, Harlan, Ky.; (2) Oscar King, City Engr. and Supt. of Utilities, Kingsport, Tenn.; (3) R. B. Coldiron, Supt. Filtration and Pumping, Danville, Ky. (Note Danville's complete representation, Manager, Supt. of Meters and Distribution and Plant Supt.—to Manager Terrell and his Board, "hats off"); (4) J. P. Brownstead, Supt of Water, Ashland, Ky.; (5) H. A. Moffat, "Nuchar" Sales, Detroit, Mich.; (6) Alfred LeFeber, Cons. Engineer, Cincinnati.

Homer Beckwith, Distr. Mgr., The Pitometer Co., Pittsburgh, Pa., was asked to describe his simple method of checking pump efficiencies. This he did hurriedly and referred the listeners to the method as published in detail in the 1940 Reference & Data Issue of "Water Works & Sewerage." (We understand that reprints of the article in question may be had if requested of Mr. Beckwith. Or, "W.W.&S." will be pleased to act in connection with such requests.—Ed.)

J. S. Watkins, Consulting Engr., Lexington, Ky., cited the case of Lawrenceburg, Ky., wherein inefficient pumps had been scrapped for modern efficient pumps and motors. This, plus a parallel new 8 inch main to reduce pumping head by 61 ft., had netted a saving of $2700 per year in operating costs. This money had been ample to cover interest charges on a $41,000 bond issue, voted in order to secure an additional $70,000 betterment project for which W.P.A. supplied $45,000. Then, too, insurance rating reductions growing out of the water supply improvements had saved taxpayers $1500 per year in reduced premiums.

"Corrosion Control" by *C. E. Trowbridge*, Sup't. of Purification, American Water Works and Electric Co., New York City.

In the chemical control of corrosion of pipe lines, Mr. Trowbridge said that the success of the method was wholly dependent upon the efficacy of the protective coating on the interior of the pipe. The commonly accepted treatments consisted of aeration to remove carbon dioxide and addition of lime. Lime treatment seems principally to create a more dense coating of iron oxide—the last constituting the real protective coating. In selecting the proper lime dosage, more than the resultant pH. value had to be taken into consideration because of the effect of degree of hardness of the water in question; the softer the water the higher is the pH value required The only certain method of evaluation lay in the stability test with calcium carbonate, and in watching the friction loss trend (C value change) by taking flow tests and observing head losses at various flows; also in watching the iron content of the dead end water.

J. W. McCoy, Sup't. of Filtration, Madisonville, Ky., reported that at his plant a pH as high as 10.4 had been required. "Calgon" has been employed to suppress the rate of deposition of carbonate coating and thus maintain a more constant condition through to the ends of the system. In winter 4 p.p.m "Calgon" had been added; in summer 2 p.p.m. A hot water boiler study had revealed the value of holding temperature to 150° F. if hot-water corrosion was to be successfully checked.

(1) C. M. McCord, Director of Water, Memphis, and Homer E. Beckwith, Pittsburgh Distr. Mgr., The Pitometer Co.; (2) H. M. Gerber, President, and "Bill" (W. H.) Lovejoy, Supt. Filtration, Louisville Water Co. (an interesting case of a municipally owned water utility retaining the designation "Water Company"); (3) Earl Mitchell, Filtration Supt., Paducah, Ky., and Robt. C. Terrell, Supt. of Water, Danville, Ky.; (4) E. L. Cantrell, Neptune Meter's Louisville Manager, and George Moore, Meter Dept. Foreman, Danville, Ky.; (5) Jas. K. Latham, and Grant S. Bell, Howard K. Bell Engr. Co., Lexington.

(1) H. C. Bristol, Supt. of Water, Alcoa, Tenn. (President of the Section) and A. E. Hargett, Ford Meter Box Co. of Wabash (a native-son, formerly Supt. of Water at Bowling Green, Ky., where he still resides); (2) J. W. MacKay, Am. Cast Iron Pipe Co., Birmingham, and J. T. Guthrie, Supt. Water, Signal Mtn., Tenn.; (3) J. S. Smalling and J. M. Gager, Jr., of Gager Lime Co., Chattanooga, Tenn.; (4) Jas. K. Latham, Howard K. Bell Engrs., Lexington, and H. G. McAndrews, Dist. Engr. Ky. Dept. Health, Henderson, Ky.; (5) E. W. Bixby and Z. A. Stanfield, Distr. Mgrs. for Pittsburgh Equitable Meter Co. and Nordstrom Valve Co., from Signal Mtn. and Memphis, Tenn. respectively.

Owen Rice, Research Engr., Calgon, Inc., Pittsburgh, Pa., reported that 30 plants had found small dosages of "Calgon" (Hexametaphosphate) helpful in conjunction with lime already being used. Roughly 50 plants were using "Calgon" without lime, the method having proved effective from pH 5.4 upwards. Not less than 70 softening plants were now using "Calgon" to check carbonate scale deposition in mains—Columbus and Dallas being the largest plants now using "Calgon" treatment.

Frank M. Tobin of the Electro Rust Proofing Co. was asked to describe the cathodic method of corrosion suppression in steel tanks and standpipes, and for submerged metal surfaces generally. He said the method, in a few words, involved the production of protective coating of hydrogen; or, in the case of hard waters or lime treated waters, a coating of calcium carbonate in addition.

"Break-Point Chlorination" by *A. T. Andrews*, Technical Service Div., Wallace & Tiernan Co., Newark, N. J.

Mr. Andrews presented a well prepared review of basic considerations in "Break-Point" controlled superchlorination. He showed typical "break-point" curves and discussed the role of free ammonia in respect to its effect on the method. [So much has appeared in this magazine during recent months on "Break-Point" Chlorination that a more detailed account of Mr. Andrews' review seems hardly warranted at this time. If there is a reader who would like the details we will see that he gets them in the form of reprints of articles.—Ed.]

J. W. Finney, Ass't. Engr., Tenn. Dep't. of Health, related a case wherein a highly colored water (80 p.p.m. color) had been subjected to super-chlorination, the break-point coming at 18 p.p.m. chlorine. The result—color, taste and odor removed. Since a heavy floc resulted from the high chlorination no coagulant was required. This water contained only 3 p.p.m. iron, which was insufficient to account for the quantity of floc produced.

John J. Quinn, Sup't. of Filtration, Knoxville, Tenn., told of an experience in super-chlorinating a pulp mill waste of 350 p.p.m. color and thus reducing it to 60 parts. The super-chlorinated waste after coagulation filtered 3 times faster than the unchlorinated samples coagulated in like manner.

W. H. Lovejoy, Supt. of Filtration, Louisville, Ky., reported that prechlorination practiced for 6 years at Louisville had lengthened filter runs and improved coagulation. Although repeated tests had revealed no "break-point" in the super-chlorination curve at Louisville, it had been noted that no so-called bacterial after growths appeared in the system when the residual chlorine was maintained above the critical point.

Concerning the effect of free ammonia in intensifying the "break-point," Mr. Andrews told of the unique scheme employed at Tarboro, N. C., where an artificial "break-point" is purposely created by adding ammonia to the water. The chlorine dosage is maintained at the constant figure of 3 p.p.m.—the ammonia serving to reduce the excess chlorine and preclude taste development out in the pipe systems.

On another highly organic water at Newport, R. I., L. H. Enslow told of the effective color destruction and the unbelievably high residual which could be carried unnoticed in the finished water—something in the nature of 5 p.p.m. residual and higher. Interestingly this non-tasting residual was not reduced by aeration.

"New Development in Filter Washing" by *J. S. Watkins*, Consulting Engr., Lexington, Ky.

Mr. Watkins presented a history of past experiences and modern trends in methods of filter washing up to the present. He pointed out that, even with vertical wash rates of 48 to 50 inches rise per minute, mudball formation had not been corrected. Shortcomings of high velocity wash alone had led to the development of a positive sand scrubbing type of wash. Known as the surface-wash, the method was introduced and advocated first by John R. Baylis of Chicago. More recently the revolving-jet agitator had been perfected by Palmer of Erie, Pa., and dubbed the "Palmer Filter Sweep." One or the other scheme had now been adopted by 50 or more plants, with ample evidence of the merits of surface wash for maintaining clean filter beds and operating economy.

At Louisville a drilled pipe grid system, patterned after the Baylis system, had been in service since 1936, reducing wash water consumption about 30 per cent. The old sand, in use for 30 years, had shrunk by 10 per cent, due to the scouring away of grain coatings of long accumulation. Following the scrubbing surface wash, a 24 in. vertical wash rate completes the job.

At the Covington, Ky., plant (designed by Mr. Watkins) the Baylis system consists of laterals of 2 in. pipes drilled on each side. The usual wash consists of 20 inch vertical rise from the under-drain laterals, plus 6 inches of rise through the surface wash laterals. The practice is to wash filters every 48 hours, regardless of loss of head, by first expanding the bed (20 inch rise) and thereafter turning on the surface wash. Discontinuing the surface wash only for brief periods has resulted in poor bed condition. Filter runs average but 13 hours without surface wash, as compared to 22½ hours with it. Mr. Watkins considered the added cost for surface wash completely justified.

W. H. Lovejoy, who designed the Louisville surface wash installation, said that the density of sand had returned to that of clean silica sand of 2.6 specific gravity, as compared to a gravity of 2.2 for the coated sand which a 36 in. vertical rise had not kept clean. The maximum rise now used (in summer) is but 24 inches, and 20 inches will probably suffice. Troubles from sand entering the surface laterals had been corrected almost completely by leaving some

surface wash flow on while the bed-floating bottom wash is reduced, and thereafter shutting down the surface wash. If sand does enter the orifices the laterals are cleared by removing end plugs and flushing.

C. E. Trowbridge stated that he finds the surface wash system all that is claimed for it. It keeps the beds better graded and the dirt and the finest sand at the surface. Experience has indicated, however, that filters should not be run too long between washes, regardless of the washing system employed.

Harry E. Jordan (A.W.W.A.) sketched a filter washing scheme on the black-board which has been developed in Johannesburg, South Africa. It involves an air wash to scrub the sand grains and bring dirt to the surface. Thereafter, with the air cut off, a sheet of water directed across the bed surface from one side to the other (narrow width) sweeps with it the major part of the dirt to a central gullet. Having got rid of the bulk of the debris with the least amount of water, the regular up-flow wash is given to complete the cleaning.

L. H. Enslow said that a most impressive part of the Palmer Surface Wash System was the fact that the complete floating sand bed seems to be circulated from top to bottom—i.e., down at the sides and upwards at the center, because the rotating jets push the floating sand to the walls, where it sinks.

"Certification of Water Works Operators," by *Jas. H. Fry,* Sup't. of Filtration, Nashville, Tenn.

Mr. Fry recited the qualifications covering the several grades of operators under the new Voluntary Operator Licensing System adopted in Tennessee, and now in operation. Space does not permit listing of the several requirements but for a Grade A Certificate the applicant must have as a minimum a high school education plus 9 years of operating experience, with a satisfactory record as to ability and dependability. The lowest grade (Grade D, to operators in communities of 15,000 population, and under, and no treatment required) requires only 1 year of experience and no stipulation as to educational background.

If the applicant fails to qualify for the grade applied for and can qualify for the next lower, he is certified accordingly for a specified period, during which he can better his status. Monthly questions mailed operators are helpful in preparation for the examination to follow. All certificates are revokable.

Mr. Fry said that already many advantages had been seen as the result of such operator certification, even though it be purely a voluntary system.

R. R. Harris (Ky. State Dep't. of Health) said that the Kentucky licensing system had gotten under way only this year. 32 Superintendents of Filter Plants had taken the examinations and 26 passed—6 being undetermined. In Kentucky the Examining Board consists of the Chief Engineer of the Health Dep't. and 5 water works operators or engineers.

Mr. Farrell (Tenn. Dep't. of Health) explained that the first requirements had been made lenient to avoid discouragement of the older operators. The plan calls for certification of the Chief Operator and his principal assistants and is supplemented by a correspondence course.

"Copper Sulphate Treatment" by *R. O. Naser,* Chemist, Lexington Water Co.

Mr. Naser, who watches the Lexington reservoirs by making microscopic examination twice weekly April to November, remarked that it was of interest that the same organism does not predominate in all four closely located reservoirs at the same time, recently there being a different species predominating in each of the four reservoirs. The thick heavy scum observed on the flocculator and settling basins at present was due to the organism colastrum which fortunately was harmful in appearance but not in taste or odor. It had proved the most difficult organism to control.

The Lexington Water Company applies copper sulphate dosages of 2 lbs./mg., with effectiveness, as frequently as microscopic counts justify. It had been found more effective to treat the entire reservoir rather than the lower half, the net effect lasting 5 times as long, therefore more economical in consequence. The predominating troublemakers controlled with the 2 lb./m.g. dosage and anaebena and aphenomezon, at a cost to the company of $900 per year.

"Pre-Chlorination" by *John J. Quinn,* Sup't. Filtration, Knoxville, Tenn.

Mr. Quinn recited his experiences with pre-chlorination during 10 years at Knoxville for bettering coagulation and maintaining basins and filters in better condition.

M. L. West, Filter Operator, Kingsport, Tenn., told of having cleared up filter bed troubles with pre-chlorination, eliminating frequent sand cleanings with caustic soda.

With a resolution lamenting the passing of three valued members—H. K. Bell, M. A. Collins and M. A. Switzer—the 1940 meeting came to an end.

Water Rates in American Cities

A 38 page brochure captioned "Water Rate Structure in American Cities," has been produced by the Public Service Commission of Wis.

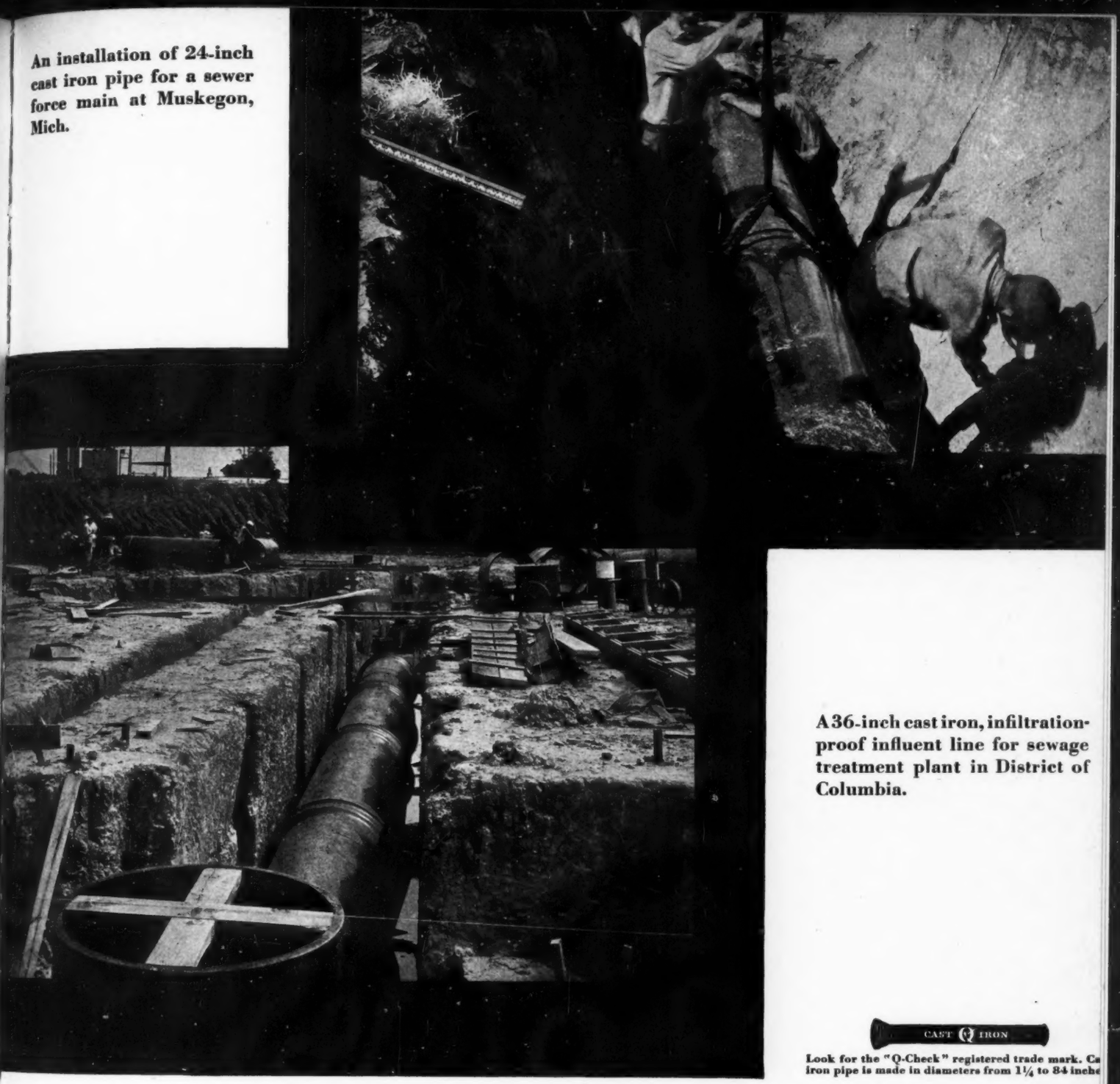
This bulletin is devoted to an analysis of water rates and charges for general water and fire service in 393 U.S. cities of 10,000 population and larger. It takes up in sequence (1) Characteristics of Rate Schedules for General Metered Service (minimum bill, service charge provisions, graduated bills, block and step rates, frequency of billing); (2) Graduated Minimum Bills and Service Charges (combining of meter sizes, level and relative scale of graduated minimum or service charges); (3) Average Length of Blocks; (4) Public Fire Protection Service (system of charging); (5) Private Fire Protection Service (types of rates, level and relative scale of charges for the service). Numerous tables illustrate representative rate structures and methods of charging for service.

In regards charges made for Public Fire Protection, it is significant that of the 316 water utilities giving information (20% not having replied at all), 51.3% report making no charge. If the privately owned plants are taken out this figure becomes much higher. It is also of interest that of the cities of 10,000 to 100,000 a higher percentage make charges than is true of the larger cities.

In regards charges for Private Fire Protection service, about 33% make no charge. The methods of those that do make charges are extremely diverse, indicative of the need for some degree of standardization in this type of water service. Further than this there seems ample need for standardization of methods and rates for consumer service also.

This bulletin will prove both interesting and valuable to water utility managers or superintendents who may be so fortunate as to secure a copy of "Water Rate Structures in American Cities" (Department Bul. No. 43) from Public Service Commission of Wisconsin, at Madison.

An installation of 24-inch cast iron pipe for a sewer force main at Muskegon, Mich.



A 36-inch cast iron, infiltration-proof influent line for sewage treatment plant in District of Columbia.

Look for the "Q-Check" registered trade mark. Ca iron pipe is made in diameters from 1¼ to 84 inche

In the last ten years this country has matched in sewage works construction the progress of the previous 50 years. Sound planning for permanency is indicated by the sharp upward trend in the use of impermeable, rugged cast iron pipe, not only in treatment plants but for infiltration-proof sanitary mains. It is the modern material for sewerage systems.

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

ENGINEERING
NEWS-RECORD
Laying 48-in. diameter cast-iron pipe for 30-mile water line across Kansas prairies.
AUGUST 15
1940
How Staggered Floor Garage Design Cuts Cost
Bridging Busy Electrified Tracks at Chicago
Wichita Makes Cast-Iron Water Pipe History

WATER FOR WICHITA

33 MILES OF BELL AND SPIGOT MAIN

● Congratulations are due those whose vision and skill planned the work—Black & Veatch, Kansas City, the Consulting Engineers; also to W. B. Carter, Wichita, the able Contractor, whose picture appears above.

A NEW RECORD IN PIPE LAYING!

22 miles of 48" diameter - the rest 42" to 14" diameter

... AND THE JOB COMPLETED AND IN SERVICE IN THIRTY-EIGHT WEEKS

You've heard about this big Kansas job, but do you know how it was possible to expedite the laying, to back fill as the job progressed, and to have the line in service in nine working months from the start?

The Wichita Water Supply Improvement job has been in the news for months. At the left you see it pictured on the cover of ENGINEERING NEWS RECORD of August 15th.

This great piece of engineering brings water to Wichita from a group of gravel wall wells located in the general area west and south of Hallstead, Kansas, 33 miles away.

KNOW ANY RECORD TO MATCH THIS?

The Engineers' specifications allowed for maximum leakage of *100 gallons* per inch, per mile. Trenches were back filled as the job progressed. No tests were made until the 33 mile line was completed. The actual leakage within two weeks after water was turned into the line was *39 gallons* per inch, per mile.

Good Pipe! You bet!! But no pipe is better than its joints. They had to use good *jointing compound* too — and they *did!* — *Tegul*-MINERALEAD—325,000 lbs. of it.

TIME MARCHES ON and the job keeps pace

The first *Tegul*-MINERALEAD joint was poured on October 7th, 1939. Winter weather made it necessary to shut down on the job for two months. Yet water was turned into the filter plant on September 1st, 1940. The actual laying time — nine months — gives some idea how *Tegul*-MINERALEAD helps pipe laying to move right along with no loss of time.

HOW ABOUT YOUR PIPE LAYING AND JOINTING?

Your job may be smaller in terms of miles and perhaps of diameters—but it's no less important to you that the joints be tight—able to withstand any vibration, also to meet extraordinary thermal and mechanical shock—and that no time be wasted in speeding your job through to completion.

RULING WEATHER TROUBLES OUT

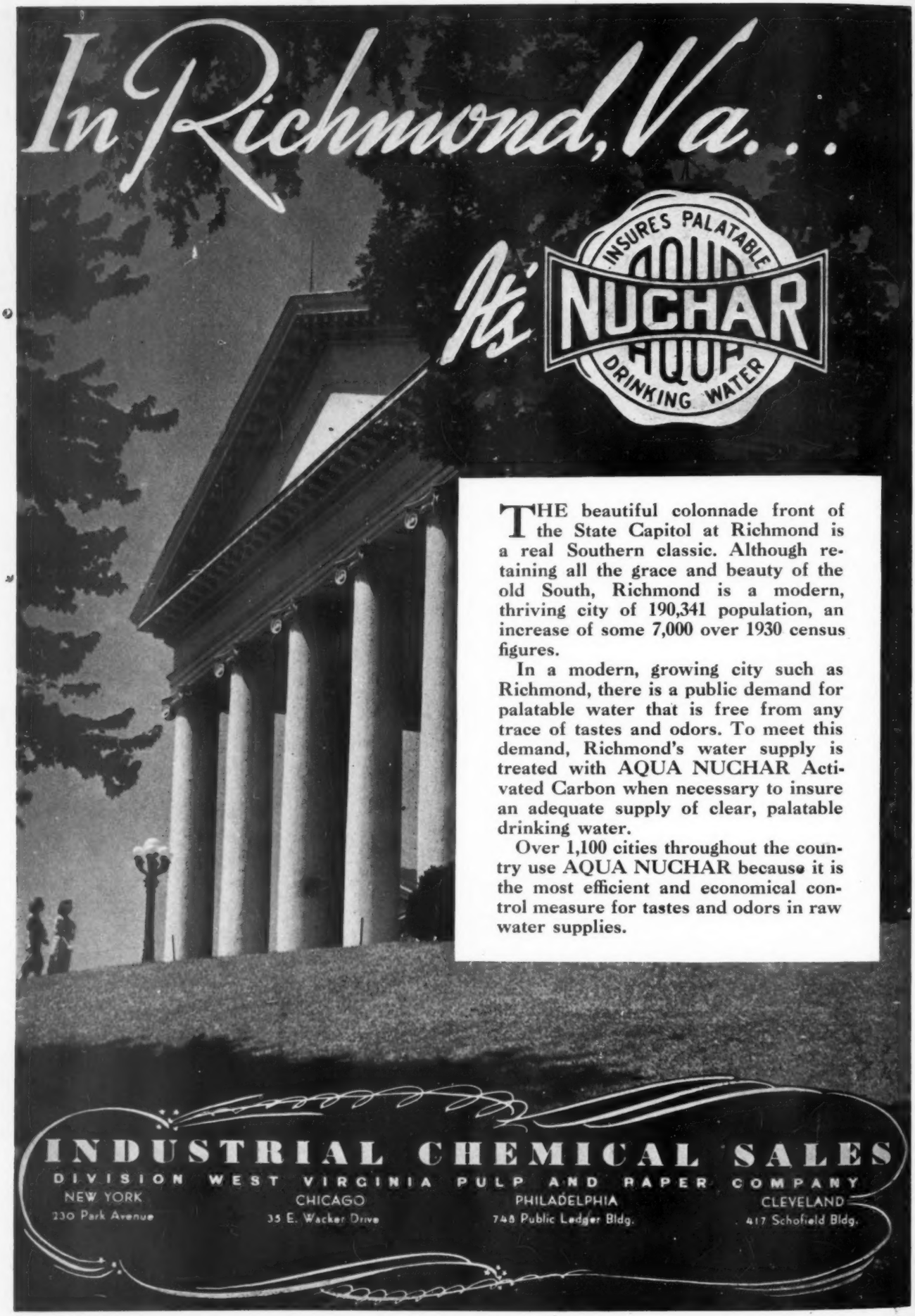
In winter and summer alike, you'll o.k. a compound that can be stored in the open with never a worry about rain, snow and flood. You'll be glad to find it can be handled easily. Those 10 lb. *Ingots* of *Tegul*-MINERALEAD make units that are convenient to ship, store and handle on the job, saving space and time, and easy on labor. Further, *Tegul*-MINERALEAD needs no caulking, no deep bell holes, no skilled labor.

If you have used *Tegul*-MINERALEAD, you're probably enthusiastic about its advantages . . . and its pleasingly low cost. If you *haven't*—then do yourself a good turn right now. Send us a line asking for Time- and Money-saving Information on the subject of Better Bell and Spigot Main Jointing.

The ATLAS MINERAL Products Company of Penna., Mertztown, Penna.

A Tegul PRODUCT — PRODUCED UNDER LICENSE FROM THE TEXAS GULF SULPHUR COMPANY

Tegul-MINERALEAD



THE beautiful colonnade front of the State Capitol at Richmond is a real Southern classic. Although retaining all the grace and beauty of the old South, Richmond is a modern, thriving city of 190,341 population, an increase of some 7,000 over 1930 census figures.

In a modern, growing city such as Richmond, there is a public demand for palatable water that is free from any trace of tastes and odors. To meet this demand, Richmond's water supply is treated with AQUA NUCHAR Activated Carbon when necessary to insure an adequate supply of clear, palatable drinking water.

Over 1,100 cities throughout the country use AQUA NUCHAR because it is the most efficient and economical control measure for tastes and odors in raw water supplies.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

NEW YORK 230 Park Avenue
CHICAGO 35 E. Wacker Drive
PHILADELPHIA 748 Public Ledger Bldg.
CLEVELAND 417 Schofield Bldg.

Ewing Galloway

N.E.W.W.A.'s RECORD CONVENTION

(*Second and Concluding Installment*)

The first installment of this report covering the record making 59th Annual Convention of the New England Water Works Association is to be found in our October issue. This installment concludes the report.

Reported by
H. A. FABER, ASSOC. EDITOR

Chemists' Session

"Sanitation and Purification of New York City's Water Supplies" —by Frank E. Hale, Director of Laboratories, Bureau of Water Supply, City of New York.

How 980 million gallons of water is obtained and protected for the City of New York each day was the story told by Dr. Hale. He pictured this vast consumption by noting that such an amount would fill enough 50 gallon hogsheads, placed side by side, to reach 8,000 miles or one-third the circumference of the globe.

Both wells of various types and over 1100 square miles of protected surface sources supply this largest and one of the most complex water supplies. All of these sources are under control of city laboratories. Long storage is the first line of defense in most instances and this insures the death of a large proportion of pathogenic organisms. Tabulated data showed progressive reduction by storage of water to reach 99.8 per cent of coliform bacteria.

On the extensive Catskill and Croton watersheds, as well as on Long Island, sewage disposal is supervised by the New York Bureau of Water Supply. Sedimentation, sludge digestion, sand filtration, and chlorination comprise the treatment in the majority of instances. Average analyses of treated sewage discharged was shown for the Mt. Kisco plant in 1939 to be typical for good well water. Where treated effluent enters creeks, trout are frequently found to swim.

The supply is equipped for chlorination at 122 separate points. All water reaching consumers has been chlorinated at least twice—frequently 3 or 4 times. In 1938, 995 tons of chlorine was applied at the various plants. Control standards for colorimetric comparison of orthotolidin residuals are provided in 0.02 p.p.m. increments and are checked twice yearly for accuracy. Residuals usually range from 0.05 to 0.1 p.p.m.

When the Division of Laboratories was first organized, the typhoid death rate was 20 per 100,000 population and has now declined to 0.3 for the same population.

Alum and lime are used to some extent for turbidity removal from Catskill water; 3,517 tons of alum and about one-quarter as much lime (to maintain pH) being applied in 1938. Many of the Long Island well supplies employ lime and aeration in iron removal plants for treatment of well waters.

Chas. H. Capen
Sanitary Engr.
North Jersey
Water Comm.

John R. Baylis
Bureau of
Engineering
Chicago, Ill.

The methods of using copper sulfate and chlorine for control of algae—in which Dr. Hale has done much pioneering work—were touched upon. Both continuous feed of copper sulphate to water in aqueducts and distribution in the reservoirs was described. Data on maximum doses permissible without killing fish were noted as applying only to soft waters in which the formation of copper carbonate takes place only slowly. [Dr. Hale later stated that most of the copper applied to Catskill and Croton supplies actually reaches the city, such being revealed by analysis of water at the consumer's taps.]

Chlorination of new mains, testing of swimming pools and research problems, such as those involving corrosion of piping and its prevention, are other problems receiving laboratory supervision or study.

C. R. Cox, Bureau of Water, Albany, N. Y., described the practice of copper sulfate application by spraying a 0.5 per cent solution as developed at Madison, Wisc. This method gives better distribution and has less effect on fish; the dose of copper must be higher in treating hard water but fish also have greater tolerance in such water and as much as 10 p.p.m. copper sulfate has been used for control of snails in swimming waters.

J. B. Muddiman, Kingston, N. Y., asked concerning progress in corrosion studies. Dr. Hale explained that neutralization of CO_2 with lime or caustic soda would prevent red water, but iron corrosion products would still deposit in pipe lines. Galvanized pipe in buildings is satisfactory for cold water, but brass or copper pipe is recommended for hot water supplies.

T. H. Wiggin, Cons. Engr., New York City, requested cost data on the supervision and treatment of this supply. Dr. Hale said that the annual budget for his Bureau was about $60,000,000.00 or nearly $2.50 per sample per year. This cost becomes very small per million gallons consumed and that, in treatment of the water, chlorination is probably the cheapest cost involved.

"Accelerated Clarification," by Franklyn J. Lammers, Asst. Technical Director, International Filter Co., Chicago, Ill.

The design and operating features of old and new styles of settling and mixing basins were reviewed by Mr. Lammers. Recent developments in which preformed floc or precipitated hardness is mixed with treated water to increase rapidity of floc or precipitate formation were described in detail as all providing improvements over older and larger equipment.

Accelerated clarification is regarded as a complete departure from this practice. It is a patented procedure based on use of returned sludge. It uses no preformed floc or contact layer. Old methods of

attempting to use returned sludge are eliminated together with difficulties due to pumping. Instead, the controlled recirculation of large amounts—300 per cent to 400 per cent — of previously precipitated sludge is employed.

In plants using this accelerated treatment process, a 30 to 40 minute detention period provides clarification at a 2 to 3 gal. per square foot per minute rate. Coagulating chemicals are added directly to a slurry zone through which the new water passes. No sludge blanket is maintained. The slurry zone in these devices is generally cylindrical in shape; propellers are used to recirculate the slurry up through this zone, and clear water is released above a hood. The physical chemistry involved in producing the tough sludge is being studied, but the process can be readily standardized.

Better than 100 of such units are now installed, mostly in connection with lime-soda softening, but some 13 units are used for high rate clarification to remove turbidity and color. Several plants were pictured and described in some detail. At Chester, Pa., a paper mill uses 2 units in very limited ground area, with saving of 2.5 times the space required for conventional units and a reduction of 83 per cent in concrete. The two units, each 54 feet in diameter, provide 12 m.g.d. of water having less than 5 p.p.m. turbidity for filtration. Filter runs average 70 to 80 hours operating at a rate up to 2.6 gal. per square foot per minute. Other municipal plants were described and savings in coagulant noted. About 25 per cent less alum dosage is expected to be characteristic.

The high clarification rates, low turbidity, and savings in both basin area and coagulant, as well as ability of these units to handle sudden overloads, were cited as outstanding advantages of this new type of accelerated clarification device.

"The Wanaque Reservoir Supply," by Lee T. Purcell, Sanitary Engineer, North Jersey District Water Supply Commission, Wanaque, N. J.

Mr. Purcell presented his paper as a motion picture with occasional commentary, describing the equipment, plants, and functioning of this supply. The information disclosed the supervision of a 95 square mile drainage area, which provides 100 m.g.d. average yield of water. Protection of the watershed, chlorinating and flow gaging

Programmers

F. J. Lammers, Asst. Tech. Dir. International Filter Co., Chicago.

Don. C. Calderwood, Engr. Pennichuck Water Co., Nashua, N. H.

C. Schwarzler, Sales Engr. The Foxboro Co., Foxboro, Mass.

stations, and laboratory control were other subjects included.

"Report of Committee on Quality Tolerances of Water for Industrial Uses," by Edward W. Moore, Chairman.

In the absence of the chairman, Stuart Coburn, a member of the committee, presented this report. Shortly to be available in pamphlet form; the tolerances will be found to cover a wide range of industrial water uses. Cooling water, steam generation, pulp and paper, laundry, brewing, give a slight idea of the subjects. Impurities which may be objectionable for each water use are listed and amounts specified. This report should be of value to a wide variety of industrial water consumers. It was accepted by vote of the members.

Water Quality in Distribution Systems

"Bacteriological and Field Studies of Conditions in Water Distribution Systems," by Warren J. Scott, Director, Bureau of Sanitary Engineering, State Health Dept., Hartford, Conn.

The discrepancy between analyses of samples of water leaving the treatment plant and of those from various points on the distribution system of the same supply was the reason for making this study of three distribution systems. For a period of one year an engineer of the state department of health visited each of the supplies weekly, to collect samples and pertinent data. The following constitutes history and facts from the case records:

Town A is supplied with water from an uninhabited watershed which feeds a reservoir of 60 m.g. capacity. The water is chlorinated after leaving the reservoir at a point about 4.5 miles from the main distribution system. Daily consumption is about 0.3 m.g.d., and chlorine dose is automatically proportioned to flow. There is evidence that, at times, higher flows occurred than were registered and that the chlorine dose was inadequate at such times.

In City B larger, but relatively clean, watersheds supply a storage reservoir where chlorine is applied before the water flows about 10 miles to the distribution system. Chlorinators are operated by means of a venturi meter and the dose was in proportion to all flow variations encountered. Average consumption is about 10.4 m.g.d.

The supply for City C is from a large, unpolluted, watershed draining into a reservoir and is filtered in a modern rapid sand plant. Finished water is treated with ammonia and chlorine, is pumped to the distribution system and to an open elevated basin which floats on the line. Daily consumption is about 0.9 m.g.d.

In this study it was attempted to maintain a 0.2 p.p.m. chlorine residual in the first two supplies, and a 0.35 p.p.m. chloramine residual in the third supply at all times. In addition to samples of the treated water, from 9 to 13 sampling points were selected on the distribution systems to provide an accurate indication of conditions. Chlorine residuals were neutralized with sodium thiosulfate.

Wide variations were found to exist in the untreated water samples from each supply during the year, and all treated water samples showed poorer bacteriological quality during the summer and fall months. Mr. Scott showed a number of slides which graphically illustrated the variations in bacteriological quality of all samples. He described how a complete interruption of chlorination for only one day greatly influenced the yearly total of quality of water in Town A. Samples in City B and City C met the U. S. Treasury Department standard for bacterial quality over a year's period, but Town A failed to meet the standard (in respect to the 5 per cent maximum allowable for three of five 10 c.c. portions), but was nearly up to requirements. In general, it was found that samples collected immediately below the points of treatment were satisfactory, and the poorest results were obtained at the most remote points of the distribution systems. Temporary

interruption of chlorination or inadequacy of chlorine dosage was found to leave after-effects such that poor distribution system samples were obtained for many days or weeks. Very rapid changes in chlorine demand of unfiltered supplies testified to likelihood of frequent inadequate chlorination.

Some of the author's conclusions as a result of this study are: Automatic control of chlorine by residual instead of by dosage is desirable; systematic sampling of distribution systems is recommended to detect failures of treatment; more laboratories should adopt a strict adherence to "Standard Methods" in order to permit comparison; and super-chlorination followed by de-chlorination of unfiltered supplies may be the answer to unsatisfactory disinfection occasionally obtained.

"Effect of 1939 Drought on Water Supply Progress in New Jersey," by Charles H. Capen, Sanitary Engineer, North Jersey Water Supply Comm., West Orange, N. J.

Mr. Capen discussed the trend toward greater progress in preventive measures against drought now being taken in cities of the East, similar to steps which have already been taken in the West. He described the dry period which, in Northern New Jersey and most of Central New York, lasted from April, 1939, until January, 1940.

By means of slides, the abnormal depletion of reservoirs in various municipalities was shown in a striking manner. The most drastic shortage of water occurred in the borough of Haledon, where silk industries use half of the normal water consumption. For a period of weeks, entire cessation of this industry and a means of livelihood for much of the population, was caused by insufficient water. Construction of 3,000 feet of 12 inch main in about two weeks enabled a supply of water to be provided from the Passaic Valley Water Commission, and this supply will now be adequate at all times.

The city of Orange had been reduced to a two weeks' supply remaining in its reservoir when the drought was broken. It has since installed a new, large capacity well and has taken other steps to prevent future repetition of 1939 conditions.

Most of the public has taken the course of forgetting the past and hoping that the future will not see a repetition of 1939 conditions.

"Three Musketeers"
Wm. B. Duffy, Supt. Public Wks. North Andover, Mass.

Tom L. Cate, Supt., Laconia (N. H.) Water Co.

Roger G. Oakman, Supt. Water Dept., Needham, Mass.

But the drought in this area has made many of those closely concerned more definitely water conscious. The State Water Policy Commission of New Jersey has progressed toward increased interconnections between the numerous sources of supply in New Jersey.

E. Sherman Chase (Consulting Engineer, Metcalf & Eddy, Boston), read a resolution following this paper: "Whereas, the problem of water works protection against sabotage and possible war-time damage is now an acute problem confronting the management of water works, be it resolved that it is the firm belief of this Association that water works budgets for the coming year should be adequate for such protective measures as may be required in each case." This resolution was adopted by the membership.

"Problems of Municipal Water Works Management," by Louis R. Howson, Consulting Engineer, Alvord, Burdick and Howson, Engineers, Chicago, Ill.

In addition to actual operation, Mr. Howson used the term "management" to include a well formulated construction program, sound financial policy, economical administration, and allocation of revenues through fair rates. A substantial part of water works revenue has been required (10 per cent to 25 per cent of the total) for financing new construction.

While the rate of population growth has been relatively slow in most cities during the depression, the investment for new construction has continued its growth due to the ever rising standards of water service. As a sound financial policy the author recommends the determination of rates which will gradually retire all outstanding indebtedness and build a well distributed construction program from revenues.

Mr. Howson believes that if the present generation of consumers pays interest on and amortizes the outstanding debt, and pays for new construction out of earnings, it is the responsibility of succeeding generations to provide for replacement (depreciation) of property from their current revenues. Financing from current revenue is only about 60 per cent as costly to the consumer as financing by bond issues.

A carefully studied program for both near and distant expansion is needed to distribute construction expenditures. It should be made and kept 20 to 30 years ahead of the present time. Good bookkeeping and statistical operating reports are essential to successful administration. An annual report has a beneficial effect on the management itself and has a value in indicating the possibilities of improvement. Instances were cited in which comparison of such reports with cities of similar size disclosed methods of increasing efficiency of certain departments or procedures.

Ownership of meters, free water, use of hydrants, etc., were further discussed. Meters, as the "cash registers" of water works, should be owned by the utility, not the consumer. There is no such thing, said Mr. Howson, as free water. Even if the municipality decides to give water without charge, it should be metered and should either be in a definitely limited amount or should be paid for at a lower than scheduled rate.

"Filter Operation and Maintenance," by John R. Baylis, Physical Chemist, Bureau of Engineering, Chicago, Ill.

Like all papers by Mr. Baylis, this discussion is not only comprehensive and thorough but presents much original information as well. A review can touch only the highlights of the paper and serve to indicate the value of studying it in detail upon publication in the Journal.

Operation and maintenance of filters in a water treatment plant is an important part of the duties involved in running the plant, and advances in water conditioning as well as chlorination—which have decreased the necessity for high filter efficiency—have caused the filters to be neglected in many places. Written instructions defining duties of operations and procedure in washing filters is advisable to secure better results and better care of such units.

A filter washing method which involves 17 individual points was given in detail. It describes what

(1) *Bill (J. W.) Wickwire, Edson Corp., Boston (Vice-Chairman Entertainment Com.);* (2) *Edw. H. Burmester, Asst. Water Commissioner, Rockville Center, L. I.;* (3) *R. C. Dennett, Engr., Natl. Bd. Fire Underwriters, N. Y. City;* (4) *Edwin T. McDowell, Supt. Biddeford (Me.) Water Co.;* (5) *"Herb" Crowell, Rensselaer Valve Co., Boston;* (6) *S. A. McAdam, City Engineer, Lebanon, Pa.;* (7) *Ben H. Keeler, Supt. Stamford (Conn.) Water Co.;* (8) *Bert Seeholzer, Jr., Hydraulic Development Corp.;* (9) *Arthur T. Clark, Sales Engr., Pomona Pump Co., N. Y. City.*

data to record; how the bed should be inspected for cracks and mud balls; exact operation of backwash and surface wash system; and placing the washed filter in operation.

Coarser filtering material and faster rates of filtration, according to Mr. Baylis, are now approaching the limits too closely to insure excellent results under all conditions of water quality. Filter operation is further affected by design, by water conditioning and by basic understanding as well as by judgment in operation.

Surges occur in the manifold and effluent lines of filters and are caused by the rapid flow of water through the venturi part of the filter rate controller. Sometimes the surging is sufficiently great to interfere with the efficiency of the filter in removing the coagulated matter from applied water. Mr. Baylis is perhaps the first to give thorough study to this significant condition, and reports that the effluent pressure surged as much as 10 inches at one plant when the rate of filtration was 2.2 gal. per square foot per minute and loss of head was between 8 and 9 feet. Poor hydraulic conditions in filter effluent conduits may be corrected readily, but, when surging is caused by rapid velocity through a venturi throat, correction of the difficulty may not be an easy task.

A successful method of comparing filter efficiency was described. This involves the use of a simple cotton plug filter to refilter from 100 to 150 ml. per minute of the sand filter effluent. The cotton and coagulated material are removed, dried, ignited, and weighed at appropriate intervals. Experience has shown this procedure to compare, more accurately than any other means, the coagulated material which passes filters.

[No matter what size of filtration plant or operating staff is involved every water works man will find much valuable and useful information in Mr. Baylis' paper.—H. A. F.]

Aqueduct Construction and Sanitation

A full half day session was devoted to papers and discussion of aqueduct construction and methods developed to preclude pollution of water supply during construction operations.

"The Delaware Aqueduct Construction" was described by Roger W. Armstrong, Deputy Chief Engr., Board of Water Supply, City of New York, who with lantern slides presented a running account of construction methods, problems encountered and methods of solution, employed on the 85 mile pressure aqueduct to bring 540 m.g.d. of Delaware River water from Rondout Reservoir (under construction) to New York's Hillview Reservoir at the north end of the city. Mr. Armstrong described the Conway Mucker equipment employed throughout in tunnelling the 23 foot bore, put through at normal rates of 200 feet per day. The lined aqueduct of 13.5 to 19.5 feet diameter is designed as a pressure conduit throughout for reasons that better performance results, less maintenance will be required, and the deep structure will be safer against damage of any sort. Construction, started in 1937 and now well ahead of schedule for placing in service in 1945, is 54 per cent complete.

Leonard Wood (Engr., New York City Board of Water Supply), gave a brief resume of 100 years of history in New York City's water supply tunnels in which the greatly increased speed of tunnel construction was emphasized. Fifty years ago the best speeds recorded on the 30 mile Croton Aqueduct was 25 to 40 feet per week; 30 years ago the records show speed on the Catskill Aqueduct of 55 to 70 feet per week; 12 years ago 100 feet per week on the Shandaken Tunnel was the top. Today experience and mechanization had doubled this to 200 feet per week, largely due to the contractor's earlier experience on the Los Angeles Aqueduct. The elaborate equipment involved is indicated by the average required investment of $750,000 per shaft. Mr. Wood stressed the excellent accident record and prevention work under safety engineers employed by the contractors and the Board of Water Supply. In regards silicosis prevention the control was believed the best ever to be perfected, making readily attainable the limits for dust particles (10,000,000 per cubic foot) set in the N. Y. State Code. Proud also was the Board of the excellent program of project sanitation, later described by Frank A. Marston.

Jas. F. Sanborn (Consulting Engr., New York City), also a scheduled discussor, pointed to the need for the Delaware supply as early as permissible if another scare of water shortage such as occurred in 1939 was to be avoided. An added 50 m.g.d. from the ground source on Long Island, now supplying 130 m.g.d. to augment the 850 m.g.d. from surface sources, seemed to be essential until the Delaware water becomes available. To date the city had been refused application made to the Conservation Commission for 100 m.g.d. additional ground water and now the 50 m.g.d. was to be applied for to meet possible emergency needs until 1945.

Karl R. Kennison (Chief Engr., Metropolitan District Water Supply of Boston), which supplies 20 cities and towns, described the more interesting features and construction aspects of the new 24.6 mile 13 foot pressure tunnel connecting Wachusett and Quabbin Reservoir; also the 13 miles pressure aqueduct of 11.5 and 12.5 foot diameter steel-cylinder concrete Lock-Joint pipes laid in cut. In tunnel construction the method of making a complete circular lining in one operation was unique. This and other developments had netted a $12,000,000 saving out of the $65,000,000 estimated cost, such saving being employed to match

Federal funds in financing the aqueduct from Sudbury into Boston. Mr. Kennison also explained the method of construction of the hydraulic fill Quabbin Dam, to form what is believed to be the world's largest water supply reservoir, holding 415 billion gallons.

"Sanitation of Construction Areas on the Delaware Aqueduct," by Frank A. Marston, Consulting Engineer, N. Y. Board of Water Supply.

Mr. Marston, a member of the firm of Metcalf and Eddy, Engrs., has been in charge of the sanitation work designed to prevent pollution of New York's water supply reservoirs as the result of construction of the Delaware Aqueduct. The several aspects of this work and methods developed proved extremely interesting. For example, this probably represents the first time that tunnel muck has been disinfected before depositing on the dump. Likewise, all water pumped from the tunnel has been heavily chlorinated and passed through clarification ponds, constructed at each shaft on the N. Y. water shed.

On the 85 mile tunnel there are 31 shaft operations. The water supply to each is hypochlorinated and the sewage is given complete treatment, involving sedimentation, slow sand filters and chlorination. The tunnels are provided with chemical toilets, regularly serviced. In muck disinfection the procedure involved a concentrated hypochlorite solution (1 per cent chlorine) which was sprayed from an overhead tank onto the muck in trucks leaving the shaft. The douche involved 4 gals. to each cubic yard of material, mostly broken rock. The cost of maintaining and operating the sanitation measures had averaged $400 per month, adding but one-half of one per cent to the cost of construction. Effectiveness of the program had been evident in the fact that no single case of waterborne disease amongst the hundreds of men employed had been recorded.

Chas. R. Cox (Engr., N. Y. State Dept. of Health), was loud in his praise of the thoroughness of the sanitation and health program on the aqueduct. Under the circumstances it was reassuring to know that although some streams were made turbid that all tunnel water had been made pathogenically safe by heavy chlorination under expert supervision. Such attainments, with 100 per cent contractor cooperation, had been outstanding.

Chemists

Fred E. Smith, Supt., Filtration, Cambridge, Mass.

Frank E. Hale, Dir. of Laboratories, Dept. of Water Supply, New York City.

Stuart E. Coburn, Chief Chemist, Metcalf and Eddy, Boston.

"Supervision of Dams and Reservoirs in Connecticut," by Clarence M. Blair, Consulting Engr., New Haven, Conn.

Mr. Blair, a member of the State Board of Engineers charged with passing on the safety of dams in Connecticut, high-lighted the new (1939) Act pertaining to the Supervision of Connecticut Dams and Reservoirs, the enforcement of which is charged to the State Water Supply Commission. The Board of Examiners consists of the Director of the State Water Commission and 5 appointed engineers. A charge of $100 is levied per inspection, but nothing in the way of Board opinion or action relieves the dam owner of responsibility in case of subsequent failure. Only dams impounding from areas of more than 5 square miles come under the new Act.

A New Pipe Lining

"Hi-Co—A New Pipe Lining," by H. J. Billings, Arthur D. Little Labs., Cambridge, Mass., and Warren A. Brown, Asst. Foundry Supt., R. D. Wood Co., Philadelphia.

"Hi-Co" is the trade name given a specially processed coal-tar lining for cast iron pipes, developed by R. D. Wood Co. for the purpose of guaranteeing a sustained high "C" value. The process of applying this lining and its qualities and characteristics were set forth by Mr. Billings, who had been in charge of the chemical and physical laboratory work in the development of process and testing work thereafter. He described the lining as consisting of a wall base of porous coked coal-tar to which more liquid coal-tar is applied to saturate the thin coke shell, sealing the pores and leaving a glossy mirror smooth surface. Thus was obtained a desirably thin lining (.004 to .005 inches thick) but one of non-porous nature, in contrast with ordinary tar-dip coatings.

The process involves adding an inert filler to good grade of processed coal-tar and lining the thoroughly cleaned pipes with the plastic mixture centrifugally placed. Thereafter the pipe is rotated in gas flames until the flash point is reached and tar coking takes place without ignition. The coke-lined pipes are then tar-dipped, during which operation the porous coke drinks its fill of the fluid molten tar and completes the operation of lining and coating. In testing the new lining the A. D. Little Laboratories literally put it through the "acid test" when filling a lined section of pipe with sulphuric acid containing copper sulphate and finding no penetration after days of standing, reported Mr. Billings. Another test proved the 100 per cent seal tightness of the lining since electric current would not penetrate it when in contact with strong brine solutions. Temperature tests proved the lining non-brittle at 30° below zero and non-sagging at 140° F.

Mr. Brown carried on from this point to show a movie picturing the several steps in cleaning and smoothing the barrels of the pipes, applying the processed tar lining, the coking stage and the final seal dip operation. Although relatively thin, the coke reinforced coating is more than 3 times the thickness of ordinary tar-dip coatings. Smoother than tar-dip the "C" value for "Hi-Co" lined 6-inch pipes proved to be 166 as compared to 161 for tar-dipped pipes. Some of the pipe has been in service in Charleston, S. C., for 2 years, and no diminution of "C" value has been noted during interim check tests by Water Department engineers.

In the discussion, *Major Leonard Wood* (N. Y. Board of Water Supply) reported observations on certain 1863 tar-dipped pipe after 60 years of service. Lack of tuberculation was striking when compared with pipe of more recent manufacture. Seeking an explanation it was found that the 1863 pipes had apparently not been cleaned of the mould sand which apparently had served the same general purpose as the ingeniously adapted coke base of the new lining.

Jas. E. Gibson (Charleston, S. C.) being in the audience, was asked what observations had revealed concerning the new lining under Charleston conditions. He said that 400 feet of 6 inch "Hi-Co" lined

pipe in service for about 2 years had been tested in place from time to time since February, 1939. With corporation cocks in place the "C" value computed for actual diameter had varied between 148 and 152 on three tests, no drop being noted during the 2 years.

"W.P.A. in the Field of Water Supply and Distribution" was reviewed by John P. Hallihan, W.P.A. Engr., Washington, D. C., in which he cited some of the most noteworthy W.P.A. water supply projects. Amongst these were projects of Portland, Me.; Boston; Providence; Manchester, N. H., involving expenditures of better than $36,000,000, of which sponsor cities had contributed but $7,000,000.

D. M. Sullivan (Distr. Engr., Water Division, Boston), in reviewing Boston's experience since 1935 with W.P.A. projects, said that early experience was anything but satisfactory. However, during the year past considerable satisfactory work had been experienced in laying large mains. The explanation was that the W.P.A. men had had more experience and key men were trained. The new "W.P.A. Contract Plan," most recently employed, had proved the most successful. In this method regular bids are taken with the understanding that the successful contractor draw on labor from relief rolls as far as permissible. A total of 185,000 feet of mains had been laid under W.P.A.

Sam'l E. Killam (Supt. of Distribution, Metropolitan District Com., Boston), in referring to the W.P.A. Contract Plan, praised the improved scheme of combining contract methods with W.P.A. labor use. The case he cited involved large main laying in which the trenching, bracing and backfilling was performed by men taken from W.P.A. rolls, while the contractor supplied all materials and laid the pipe. Of this W.P.A. work no criticism of any sort had been heard and the contractor had actually found it hard to keep up with the trenching crews. The scheme seemed ideal and everyone apparently was satisfied for the first time on W.P.A. projects in which time of completion was anyone's guess on earlier undertakings.

Linn H. Enslow (editor WATER WORKS & SEWAGE), referred to the general satisfaction expressed by contractors, engineers and sponsors having experience with the logical "W.P.A. Contract Plan," which reduced money waste to a minimum. In questioning the W.P.A. representative it was learned that W.P.A. looked, on the whole, with considerable favor on the Contract Plan. Under this method 95 per cent of the W.P.A. grant was earmarked for use in paying men taken from relief rolls whenever such men were available. In reply to a second question by Mr. Enslow, Mr. Hallihan stated that the contractor did have control over the men paid from the W.P.A. grant, inefficient labor being subject to elimination or replacement by more efficient men.

(Certainly this is an important aspect of the scheme and accounts, in a major degree, for the favor in which the W.P.A. Contract Method is held by those experiencing earlier methods of supplying labor on W.P.A. projects. Those interested in this improved method may obtain requirements and approved procedure covered in a special W.P.A. bulletin obtainable from the Washington office.—Ed.)

Meter Specifications

The status of the work of the Joint Committee on Meter Specifications A.W.W.A. and N.E.W.W.A. was reported by Richard H. Ellis, as Chairman of the New England Committee.

In pointing out comparisons between the existing specifications (1921) and the principal changes now proposed, Mr. Ellis directed attention to the following points pertaining to displacement meters.

(1) Permitted head losses through ⅝, ¾ and 1 inch meters at rates of 20, 30 and 50 g.p.m., respectively, becomes 15 lbs./square inch as against 25 lbs. now permitted. For larger meters the maximum allowable loss of 25 lbs. is cut to 20 lbs.

(2) Pistons are to be vulcanized rubber, flat or conical discs to have metal reinforcing or equipped with thrust rollers. Piston speeds limited as follows:

Size inches	Rev./cu. ft.
⅝	435
¾	250
1	115
1½	50
2	30
3	15
4	7

(3) Bushing of hard rubber are a requirement for lower bearings of pinion and spur gear spindles. Oil enclosed gear trains are now included, separate housings or their equivalent being required.

(4) Registers must have specified materials for bushing spindle bearings. Maximum indication for the initial dial and minimum capacity for the whole register are to be incorporated.

(5) Registration accuracies call for 98.5 to 101.5 per cent at any rate within normal test limits (formerly 98 to 102 per cent). On minimum test flows, accuracy of 90 per cent is raised to 95 per cent or better. The manufacturer is required to supply a sample of meters bid on together with accuracy data and pressure loss graphs for various flows.

(6) Frost protection bottoms or other devices must be so in fact as well as in name, yielding before damage is done to other parts.

(7) External bolts on meters 1 inch and smaller are to be of corrosion resistant nonferrous alloys. On meters 1½ inch and larger protectively treated ferrous metal or alloy may be employed.

(8) Spuds on ⅝ inch meters may be threaded ¾ or 1 inch; on ¾ inch meters, 1¼ inch; on 1 inch meters, 1¼ or 1½ inch—all threads being of standard pipe size. Tail pieces for ⅝, ¾ and 1 inch meters may be threaded ½ or ¾ inch; ¾ or 1 inch; 1 or 1¼ inch, respectively.

(9) Regarding standard threads for spuds and couplings, threads used by the several manufacturers have been studied. It is probable that a new straight standard thread will be adopted as standard. Thus meters of any common size (old or new) will become interchangeable with each other.

"Report of Committee on Water Works Education," by Robert Spurr Weston, Chairman.

Mr. Weston described the lectures on hydraulic fundamentals which have been a feature of the monthly meetings of the Association. The usefulness of these lectures has been well proven, and it was recommended that they be continued for the coming year. The report and recommendation were approved by a member vote, with thanks to the Committee.

WISCONSIN SECTION MEETS IN MANITOWOC

UP in Manitowoc, where the October air was fresh and frosty, and seemingly awfully good to live in, Wisconsin's Section of A.W.W.A. held its 19th Annual Convention on October 15th and 16th. Not counting the ladies, the registered attendance was 176, of which 130 were operators and engineers and 46 were manufacturers' representatives. Since the ladies' names did not appear on the registration list no count of the fair sex is available.

Chairmen

(Retiring)
Albert E. Hintz
Water Dept.
Mgr.
Oshkosh, Wisc.

(Incoming)
Jas. M. Myers
Supt. Water
Dept.
Kenosha, Wisc.

Unfortunately, along with Vice-President Howson of A.W.W.A. and Wisconsin State Sanitary Engineer Warrick, the writer was detained in the Chicago Lake Diversion hearings before the U. S. Supreme Court and the three of us had to miss the first day of the meeting. In consequence, this report is confined to proceedings of the second day only.

Annual Banquet

Fortunately, we were able to reach Manitowoc on the evening of the 15th, barely under the wire for the tasty Annual Dinner and to keep Vice-President Howson's promise to appear at that time and say something. He did, and it was "short and sweet"—fact is, we cannot recall having heard any other "speaker of the occasion" for which an audience stood up twice in less than five minutes. Judging from the applause it was the kind of speech they liked. He commented on the 40 per cent membership increase in A.W.W.A. every year since its reorganization, and the worth of sectional meetings to 70 per cent of the membership of A.W.W.A. which the records show attend such meetings. He complimented the Section on the quality and quantity of attendance at this meeting, as has already been indicated by the registration figures noted.

Following Mr. Howson's brief talk and greetings from the Manitowoc officials, the show was on. Featured were several acrobatic numbers by a group of Manitowoc youngsters, amongst which were two of the children of our host—W. C. Staeffler, Manitowoc's Manager of Public Utilities. And, these youngsters were really good.

Incidentally, the singing by members and guests around the dinner tables was in this writer's opinion about the most pleasing of any singing of the sort ever heard—lots of good harmony up there in Wisconsin.

Awards and Prizes

To Arthur P. Kuranz, Sup't of Water at Waukesha, was voted the George W. Fuller Award "in recognition of his work in advancing meter maintenance in Wisconsin and elsewhere."

In the Gadget Contest the first prize was won by J. J. McCarthy, Chief Chemist, Racine Water Dep't, for his photo-electric turbidity meter.

Officers:

The following officers were elected for the ensuing year:

Chairman—James M. Myers, Jr., Sup't, Kenosha, Wis.

Vice-Chairman — Jerome Zufelt, Sup't, Sheboygan, Wis.

Sec'y-Treas. — Leon A. Smith, Sup't, Madison, Wis.

O. J. Muegge, Ass't Engr., State Dep't of Health, was elected a Section Director.

Herbert H. Brown, Ass't City Engr., Milwaukee, is National Director representing the Section.

Papers and Discussions

(Round Table Session)

"Meter Maintenance Practices," by A. P. Kuranz, Sup't of Water, Waukesha, Wis.

Mr. Kuranz, confining his discussion to maintenance of ⅝ inch meters, was of the opinion that in setting up a high standard of performance for new meters it was equally important that a high standard of maintenance be instituted to insure a continuation of such standards for in-service meters. Therefore, every meter brought into the shop should be tested in nowise differently from the tests applied to new meters, including the ¼th gal./min. flow. One thing *not* to do, said Mr. Kuranz, is to place the meter on the test bench in reverse and thereby clean out considerable of the deposit of years of accumulation.

Host—Vice Pres.—Director

Wm. C. Staeffler, Mgr., Utilities
Manitowoc, Wisc.
(Section Director and Host.)

L. R. Howson, Cons. Engineer
Chicago, Ill.
(Vice President of AWWA.)

Herbert H. Brown, Asst. City Engr.
Milwaukee, Wisc.
(National Director, AWWA.)

In repairing meters showing a poor registration record he cautioned against trying to fit new discs into badly worn chambers, but instead adopt as a general practice the replacement of both chamber and disc, as an assembly. And, if the gear train is at fault and is of the open type it might be junked and replaced with a modern oil-enclosed train now manufactured by all meter makers.

If after repairs the meter fails to register as much as 95 per cent of the flow at the ¼ gal./min. rate it is not right. Try again, for this figure can be secured in the end.

The natural question raised is "What is the economic limit of expenditure in labor and repair parts, per meter, to maintain accuracy?" In general the answer is about this: To test a meter, take it apart, clean it (scraper and brush—no acid dipping), reassemble it and test again, should consume not more than two hours of one man's time. Whenever the repair work is to cost more than half the price of a new meter

Honored Member

A. P. Kuranz, Supt. Waukesha, Wisc. (To him the 1940 Fuller Award.)

Best Gadget

The Racine Turbidity Meter. (Inventor McCarthy, the prize winner.)

such a meter is better consigned to the salvage pile.

To answer the question: "Does all of this maintenance work pay in the long run?" Mr. Kuranz said that he could answer in his own case—i.e., the Waukesha case. History showed that only 60 per cent of the pumped water was being registered on meters in 1931. A rate increase of 22 per cent seemed inevitable, and had been approved by the Public Service Commission. It was decided, however, that the meter registration situation should be investigated first. Meters were put in good condition and income per meter overhauled went up to prove the value of going over the entire system, replacing chamber and disc assemblies and substituting oil-enclosed gear trains. Although Waukesha was considered essentially completely metered, the word "complete" was made to have a true significance *only* after it was applied to registration accuracy as well as number of installations. Interestingly from 1931 to 1940 added meters to the system had increased only 130 in the 4,282 total (only 3.1 per cent); *but*, the total revenue had increased by 21 per cent in the same period. So instead of making the rate increase in Waukesha, there have been rate reductions and still the reasonable 5.5 per cent net earnings on valuation is being realized. This experience, said Mr. Kuranz, would seem to answer both questions. Does it pay to maintain meter accuracy on all flows? IT DOES, if done scientifically and with a fair degree of intelligent judgment.

(What we would interpret from Mr. Kuranz' experience, and that of others, it has never paid to go into meter maintenance on a halfway scale. It seems to be a question of "whole hog or nothing" when it comes to proving that good maintenance practice really pays its way and yields profits.—Ed.)

Mr. Kuranz then revealed the results of making a study of consumption characteristics on domestic services with 3 recording "Meter Masters," records covering 2,223 hours on many services over a period of 18 months. The following table reveals the general average of per cent of total water used, which is drawn at the various rates listed.

Flow Rate (G.P.M.)	Per Cent of Total
less than ¼	9.1
¼	4.5
½	1.8
1	5.0
2	11.8
4	52.4
6	14.7
10	0.7

It was surprising that a 7 day record chart on an apartment house revealed 6 g.p.m to be the maximum demand rate. This observation changed some ideas concerning proper meter size for such a building. As a means of studying water demand, meter sizing, accuracy, leakage, and settling complaints, Mr. Kuranz was high in his evaluation of the recording "Meter Master."

Jas. M. Meyers, Jr. (Sup't at Kenosha, Wis.), having two "Meter Masters," said that the value of these instruments could hardly be overemphasized. In Kenosha the 90 day strip chart model is used and is especially valuable in connection with large industrial meters and compound meters, some of which the charts revealed were missing much of the flow because a high percentage of the flow was close to the point of change-over for the meters—some being only 48 per cent accurate in this zone.

Concerning meter maintenance and field study, as indicated, the per cent of water collected for in Kenosha had been raised from the 72 per cent figure of some years back to 88.5 per cent in 1939. The revenue increase of $11,000 annually could mostly be accounted for through improved metering of industrial services and large users.

Mr. Kuranz later mentioned the fact that a meter on test might indicate 108 per cent registration on high flows but fail to even turn on flows less than ½ g.p.m. Such a condiiton could be traced to formation of encrustations in the measuring chamber, to reduce its volume but likewise to cause the disc to stick and permit considerable leakage past it. In reply to

James E. Kerslake, Supt. of Filtration Milwaukee, Wisc.

Joseph P. Schwada, City Engineer, Milwaukee, Wisc.

Walter A. Peirce, Water Dept. Manager, Racine, Wisc.

a question, he said that acid cleaning had been tried but the "brush and elbow grease" methods seemed preferable. A scheme of treating the measuring chamber and discs with hot vegetable oil was under trial as a means of reducing scale formation and disc sticking.

Concerning the over-registration of meters after long service, Mr. Myers stated that 43-year-old meters had shown 104 per cent on high flows in Kenosha but poor registration at low flow, just as Mr. Kuranz has observed.

Linn H. Enslow (Editor, WATER WORKS & SEWERAGE), cited a method of getting around the matter of low registration of compound meters in certain installations where the change-over point is the cause of the deficiency. The scheme was credited to D. R. Taylor of Roanoke, Va., and consisted of installing a by-pass around the compound meter in which is placed an ordinary displacement meter. Taking much of the load from the compound, except for a suddenly high demand all consumption passed through the low flow side of the compound. In summer when the meter load mounted, to supply air cooling water, the bypass is cut off and the prevailing flow is all through the high flow side of the compound. Thus the same meter serves under a greater variety of prevailing flow conditions, saving seasonal replacement of the unit to preclude a considerable revenue loss.

Mr. Enslow also told of Taylor's (Roanoke) scheme of inserting a gear of ratio of 1 to 7.5 in the "Meter Master" cable in order to make the recording unit show gallons for the benefit of consumers' understanding, rather than in cubic feet which the customer couldn't conceive so well. He understood that these cubic feet to gallon converters could now be had from the makers of the "Meter Master" at a nominal cost.

"Construction of Mains and Serv-

ices," by Harold L. Londo, Acting Sup't, Water Dep't, Green Bay, Wis.

Mr. Londo's paper related methods employed in laying cast iron mains, favoring the shaped trench bottom as the safest practice. Concerning jointing and sterilization of new mains so much difficulty with joint packing had been experienced that they had decided to try abandoning jute for rubber packing. In Green Bay no method of jute or main sterilization tried had proved a permanent remedy for high bacterial counts from the jute.

As to service lines, all such up to 1½ inch diameter are made with copper tubing and Mueller fittings. Regarding the size of the service line, the Department decides. The average cost per domestic service is $18.38, but the minimum charge to the consumer is $25.00 and anything above this figure that the installation may cost. In streets to be paved services are installed from main to curb before paving is put down, but the propery owner is not billed until actual use starts.

Harold Londo
Acting Supt.
Green Bay, Wisc.

J. H. Kuester
Menasha's Supt.
(Gadget Chm'n.)

In the discussion following, the question was raised as to methods of charging for service installations, the opinion being that the business-like basis was that of charging at actual cost plus a reasonable profit, if any, rather than on a minimum or flat charge basis.

Concerning main steriliziation, there was a general agreement that it was a pretty tough problem. The use of rubber packing had been found rather difficult with wet pipe, the rubber popping back whether the solid wedge packing or the tubular type was used. Someone suggested the "Hyde-ro" Rubber Ring recently perfected by R. H. Hyde, Manager of the Campbell Water Company, Campbell, Calif., and described in the September issue of WATER WORKS & SEWERAGE.

Frank K. Quimby (Engr. Racine Water Dep't) cited a failure to secure permanent effects after sterilizing a dead-end main for the 6th time. The practice is to use 50 p.p.m. chlorine, have a residual of 20 p.p.m., allow three days' contact and flush. Sampling shows service water O.K. but hydrant flush samples show up bad regardless.

"Wheel-Horses"

Lou. Warrick, State San. Engr.
Madison, Wisc.
(Stays in the background, but we would call him the Section's "Stage-director.")

Leon Smith, Water Supt.
Madison, Wisc.
(Long Secy.-Treas. of the Section.)

Jerry Zufelt, Water Supt.
Sheboygan, Wis.
(Section's New Vice-Chairman.)

C. K. Calvert (Sup't, Filtration, Indianapolis), cited some experiences with methods of main and jute sterilization. In his belief no dead ends will remain sterilized or can be maintained in good condition within practical methods now known. Some bacterial-growth even takes place on sterilized rubber.

"Electrical Grounding to Water Mains," by Walter A. Pierce, Manager, Water Dep't, Racine, Wis.

Mr. Pierce, in reviewing progress with studies of the effects of grounding to water piping, stated that there was no longer doubt that A. C. current had been responsible for damage to meters, services and water quality, and at times a distinct hazard to workmen removing meters or repairing services. He cited the paucity of cases brought to the attention of the joint committee studying the grounding problem, and the need for more data than has been accumulated for the purpose of devising ways and means of improving or else eliminating present day water pipe grounding practice.

In reply to questions, Mr. Pierce stated that joint insulation ahead of meters had been used by some cities to protect meter and workmen. The driving of deep grounding rods had been practiced in Australia and also in England to some extent. Such were satisfactory if sufficiently deep driven and not too close to buried water piping. As to the legal responsibility angle, there was some question that a water utility could safely order ground connections to piping discontinued. It was advised against until more definite legal opinion is available.

C. K. Calvert revealed experiences in Indianapolis wherein sulphate splitting organisms, growing in slime in stub mains and valves, had actually been responsible for graphitization of the cast iron. The process seemed to be the same as has been observed on mains laid in marshy mud areas near the ocean. So this bacteria harboring slime in mains had more angles than that of bacterial aftergrowths alone.

The Question Box

In the "Question Box" period the following facts were established: In Wisconsin an unpaid water bill constitutes a lien on the property. However, if a customer leaves a high bill at one property and moves to another service can not be denied at the new property. Only the owner of the old property can be held—so property buyers, beware. Also, a property owner can order water shut off regardless of fact that tenants may be occupying the property.

The Value of Pipe Pushers—It was revealed that pipe pushers or boring machines are worthy units and, even though sometimes tedious to operate, it pays to spend considerable time in using these devices rather than to cut expensive pavings. One member had satisfactorily pushed pipe under paving for 165 feet, where boulders did not interfere. The best practice was to push through extra strong pipe first and follow with that to be installed.

Pipe Locators and Leak Detectors—Heller of Kenosha considered a pipe locator indispensable but warned that patience was needed with the wiring hook up in many instances. As to leak-locators there was some question as to the dependability of the radio type locators. Zufelt of Sheboygan, having poor experience with such an instrument, considered the geophone at night the most practical scheme still.

"Adaptations of Photo-Electric Cells," by J. J. McCarthy, Chief Chemist, Water Dep't, Racine, Wis.

Mr. McCarthy, who won first prize in the Gadget Contest for his photo-electric cell turbidity meter, described a similar two cell instrument for measuring residual chlorine. The ortho-tolidin method is employed in developing the color which is evaluated in the Racine Residual Chlorine Meter on a milliammeter actuat-

ed by the photo-electric eye. The instrument is calibrated with chlorine water of various residual chlorine values. The machine has the advantage of constant light conditions and no human equation. The disadvantage is that only perfectly clear and colorless water can be used in it.

Mr. McCarthy pointed out that for Lake Michigan water more than 1 ml. of standard strength (acidity) ortho-tolidin solution per 100 cc. of sample is required for full color development within reasonable contact time. For full color development within 15 minutes at 38° F., 3 ml. of ortholidin is employed.

Water Softening in Wisconsin

"What Water Softening Can Accomplish for Wisconsin," by L. R. Howson, Consulting Engineer, Chicago.

Mr. Howson, in a very clever analysis pictured the monetary savings which softened water would bring to Wisconsin citizens, now supplied with waters of more than 120 parts hardness. This group represents 40 per cent of the urban population of the state. Taking the 340,000 water users involved and adding up the soap at $1,200,000, plumbing at $400,000, automobile radiators at about $500,000, the total savings on water reduced to 85 part hardness runs to almost $4,000,000.

Then he turned to the comparative cost of individual household zeolite softeners (of which there are 5,000 in the city of Madison alone at a cost of $375,000) and municipal softening. Mr. Howson reached the conclusion that a municipal plant would cost only one-half as much as the household units and likewise about one-half as much to operate and maintain.

"Break Point" Chlorination

"Break-Point Chlorination," by C. K. Calvert, Sup't of Filtration, Indianapolis Water Co., Indianapolis.

Mr. Calvert, in recounting the merits of "Break-Point" chlorination, as an oxidizing effect destructive of ammonia and other oxidizable compounds in waters, exhibited graphs picturing the effects of ammonia and other compounds on the well-known break-point curve. In this method of super-chlorination only a dosage of chlorine assuredly beyond the observed break-point had proved effective in destroying tastes created by the organism synura at Indianapolis. A lesser dosage had destroyed other taste producing substances, the chlor-phenols, for instance.

(1) *Louis A. Bibelhausen, Supt. of Purification, Neopit Indian Reservation;* (2) *Ernst E. Schneider, Supt. of Water, Cedarburg, Wis.;* (3) *George B. Prindle, Supt. of Water, Highland Park, Ill.;* (4) *Richard Zimmerman, City Clerk, Waupun, Wis.;* (5) *Wm. U. Gallaher, Supt. of Water, Appleton, Wis. (With apologies to his Commissioner, J. B. Wagy, whose picture we "fluked" on);* (6) *Jerry Donohue, Pres. Donohue Engineering Co. of Sheboygan (Designer of Manitowoc's new Sewage Treatment Plant).*

In removing or nullifying the excess chlorine sulphur dioxide or ammonia could be used—the last in the ratio of 1 part of ammounia to 10 parts of residual chlorine.

At Indianapolis a combination of copper sulphate and heavy chlorination is employed in the control of certain algae forms—the two being fed together for best effects. The present routine practice is "break-point" chlorination, applied to the raw water continuously, aided by copper when needed. A very practical control test, to determine that the break-point has been exceeded with the dosage applied, is the titration of two portions of the same water sample for residual chlorine. One portion is titrated without acidification, the other being acidified. If the latter yields more apparent residual than the neutral sample such is evidence that the intermediate chloro-compound, formed with less than oxidative chlorination which takes effect beyond the "break-point," have not been destroyed and tastes may be expected along with less effective bacterial kill. Another check test is the rate at which the color developed with orthotolidin reaches a maximum value. At full (saturation) chlorination the color reaches a peak within the first minutes of standing. If longer than one minute the two titrations will not check and a higher dosage of chlorine is indicated.

"Some Problems in Handling Activated Carbon," by James Kerslake, Sup't of Filtration, Milwaukee.

Mr. Kerslake, in discussing problems experienced at the Milwaukee plant in storing and handling powdered activated carbon, reported that three smouldering fires in the carbon bins had been attributed to spontaneous combustion. The only indication that there is a fire is the heating of the hoppers and gray ash in the corners. Such fires are readily checked with carbon dioxide purchased in 10 and 20 lb. cylinders at 17½ cents per pound. Another scheme was to drop a chunk of dry ice (3½ cents per pound) into the hopper or storage bin. The quantity of CO_2 required is 1 lb. for each 12 cubic feet of carbon in the hopper.

Considering the possibility that the volatile content of the carbon might be responsible for the ignition, an experimental bin of lower volatile carbon is being tried to test this theory.

Inasmuch as the carbon feeding facilities of the plant must be increased to meet peak demands it has been decided to provide wet storage and solution feed. The storage slurry will carry ½ lb of carbon to the gallon.

The plant of the Southern California Metropolitan Water District will employ the wet storage and solution feed method with a slurry of 1 pound of carbon to the gallon.

Tank Painting Racket

Max Whitacre, Chicago Manager for Pittsburgh Des Moines Steel Co., issued a word of warning to members to look out for a racket in tank cleaning and painting. The racketeer gives an exceptionally low bid for the cleaning and painting job, but in the contract is a stipulation that for every rivet which must be cut out a charge of $1.00 per rivet is to be made. In one case 1,728 rivets were replaced. This outfit only works its racket on the smaller towns. Mr. Whitacre suggested that if rivets should ever be required the tank manufacturer should be advised.

The closing paper on the program was one by W. R. Brookman, Exec. Sec'y, Illinois Master Plumbers' Ass'n, who used a moving picture film to illustrate "Back Siphonage Through Plumbing Cross Connections."

A MULTIPLE NOMOGRAPH FOR CHLORINE DEMAND DETERMINATIONS

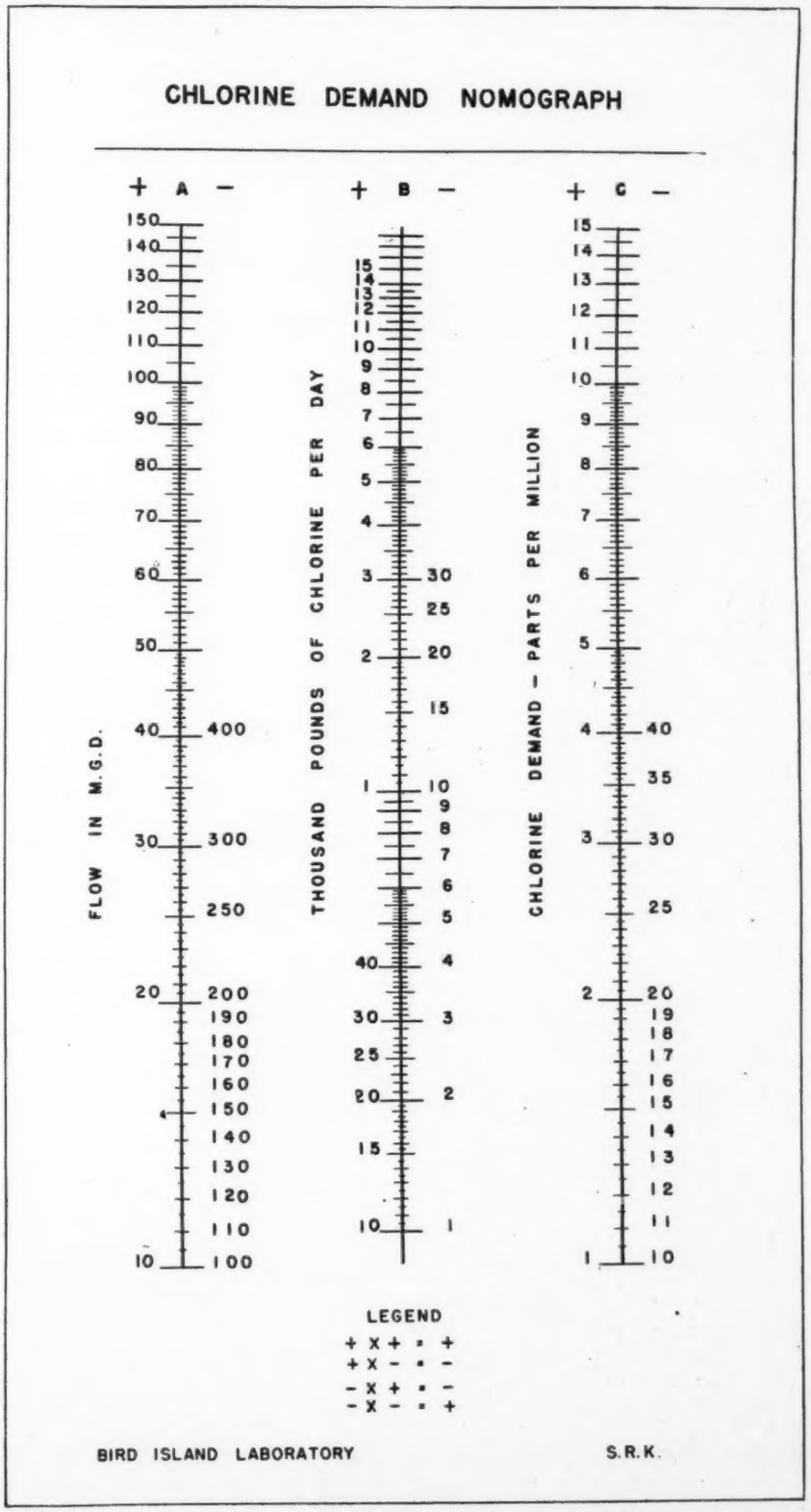
By G. E. SYMONS[1] and S. R. KIN[2]
BUFFALO SEWER AUTHORITY
BUFFALO, N. Y.

THE determination of the proper chlorine dosage in a water or sewage treatment plant is one of the functions of the laboratory. In plants where the flow and chlorine demand are low and where infrequent adjustment of the dosage is necessary, the calculation of the pounds dosage from the chlorine demand in p.p.m. and flow in m.g.d. is relatively simple. Under circumstances where flows and demands are large and variable, and a more frequent dosage adjustment is justified, it becomes feasible to eliminate frequent calculations by the use of a nomograph.

A nomograph for chlorine demand has been published in "Technical Publication No. 177" by Wallace & Tiernan, Inc. That nomograph has the advantage of being applicable to analyses reported in both parts per million and grains per gallon, but the flexibility of the graph is not sufficient for large quantities. A factor of 10 or 100 may be used but these factors may necessitate mental gymnastics to properly place the decimal point. The graph may be extended, but an extended graph may call for an angle made by the straight edge with the horizontal, considerably greater than 45°. The best results are obtained from a nomograph when this angle is not more than 45° and the application of correction factors is brought to a minimum.

A multiple nomograph for use with high demands and flows was prepared in the Bird Island Laboratory of the Buffalo Sewer Authority. It is presented herewith. A few comments regarding its construction will serve to clarify its use and application.

The three scales are drawn with logarithmic spacings. Scale "A" reads in million gallons per day; Scale "C" reads in parts per million; the center scale (B) reads in thousand pounds per day. All three scales are calibrated on both sides with the values



[1] Chief Chemist. [2] Asst. Sanitary Chemist.

on the right being 10 times those on the left, except that the center scale has two calibrations on the left, the lower one of which is 100 times the other. At the top of each scale is a positive (plus) sign on the left and a negative (minus) sign on the right.

Using the Nomograph

In reading the nomograph to determine the chlorine demand or dosage in 1000 pounds per day from the p.p.m. and the flow in m.g.d., a simple algebraic rule for multiplication must be remembered, viz., plus times plus equals plus, plus times minus equals minus and vice versa, and minus times minus equals plus. Therefore, if the A+ and C+ scales are used, read on B+, or if A+ and C— are used, read on B—, or if A— and C— scales are used, read B+.

The use of these scales in this manner allows a range of from 1 part per million and 1500 m.g.d. to 150 p.p.m. and 10 m.g.d. with the thousand pounds per day varying between 0.1 and 1500. Factors or multiples of 10 extend the range in both directions. By the use of factors or multiples, the readings can always be kept in the area most easily read. A factor of 1000 will easily convert thousand pounds per day to pounds per day. Scales "A" and "C" can be used for quantities rather than rates per day, in which case Scale "B" reads in quantities rather than rates per day.

Other Applications

The nomograph has other applications than in chlorine application. It may be used to calculate pounds or thousand pounds of solids in sewage, or sludge, from the analysis and the volume, and for other purposes.

This type of nomograph has several advantages, its use is simple, it gives relatively accurate readings, its system and use can be easily taught to routine control men and it eliminates much calculation where the chlorine demand determination is made frequently.

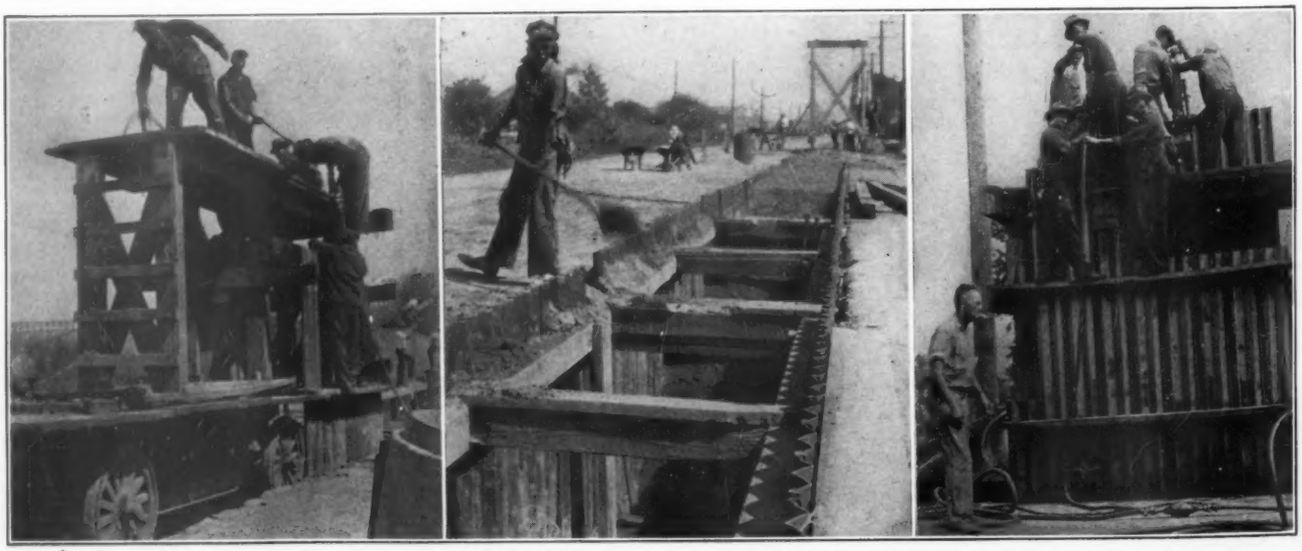
CORRUGATED SHEETING USED IN SEWER CONSTRUCTION

G. ROBERT GREGG, Sup't. of Sewers and Drains, Louisville, Ky., conceived the idea of driving corrugated metal sheeting in constructing a new sewer in Louisville. This sewer consisted of 2910 feet of 33 inch pipe and 347 feet of 18 inch at an average depth of 18 feet. Since there were no underground utility services of moment crossing the new sewer, Mr. Gregg decided on driving two lines of the 14 foot lengths of sheeting ahead of the trenching machine. The sandy-gravelly soil made driving comparatively easy and inexpensive and the 580 units of 1 foot wide sheeting (sufficient to sheet both sides of 290 feet of trench) were pulled and continuously redriven, ahead, as the trenching progressed. All units were redriven 35 times or more.

For this purpose a Driving Rig was made merely by building an elevated platform on an old ash trailer here pictured on the left. From the two sides of the platform crews with air hammers delivering 100 lb. blows at 500 per minute did the driving, this operation at two elevations being pictured on the right. In the center is the net result—a trim, safe and economically sheeted sewer trench averaging 18 ft. in depth. The units were pulled by use of a hand-winch and hooks fitting in the two pulling holes in each.

After the 3257 ft. sewer was completed another sewer 2700 ft. long was similarly constructed except that stiff clay prevented driving the sheeting full length before starting to trench. The driving ends of some sheets became damaged from repeated driving but were kept trimmed to smoothness with a portable emery wheel. Although first cost was naturally higher than wood sheeting previously employed overall cost was less due to no losses from brooming, splitting, etc., experienced with wood sheeting.

The sheeting is a relatively new type supplied by The American Rolling Mill Company of Middletown, Ohio. The heavy No. 8 gage metal strips, driven with cast iron driving heads, have two corrugations each 2 inches deep and 6 inches apart, crest to crest, making the net width just 1 foot. On each edge is a flange 1½ inches deep—from this it is known as flanged type sheeting. The 14 ft. units, weighing 150 lbs. each, were readily handled by two men.



The Gregg Method of Sewer Construction at Louisville.

Come down to earth with Calgon

WHETHER you operate a softening plant, and are trying to approach the "stability pH" from the upper side, or work with a soft corrosive water, and are adding alkali to increase its pH, you need Calgon.

Why? Because Calgon not only prevents the precipitation of calcium carbonate at high pH values, but also inhibits corrosion at pH levels even as low as 5.

No longer need you wonder just what optimum pH to maintain. No longer need you teeter on the "tightrope of pH" endeavoring to prevent deposition of calcium carbonate scale in mains, meters and hot-water heaters on one hand and yet avoid complaints due to "red water" on the other. Come down to terra firma by adding Calgon in amounts as small as 0.5 to 1 ppm. and forget scale and corrosion.

You may not believe this. At first we didn't believe it ourselves. All we ask you to do, therefore, is to do what we did—*Prove it Yourself.* We'll gladly send a free sample and complete information without obligation. Just send in the coupon.

calgon, inc.
300 ROSS ST. PITTSBURGH, PA.

WATERWORKS APPLICATIONS OF CALGON*

Calgon, a molecularly dehydrated sodium phosphate glass, solves four major water problems:

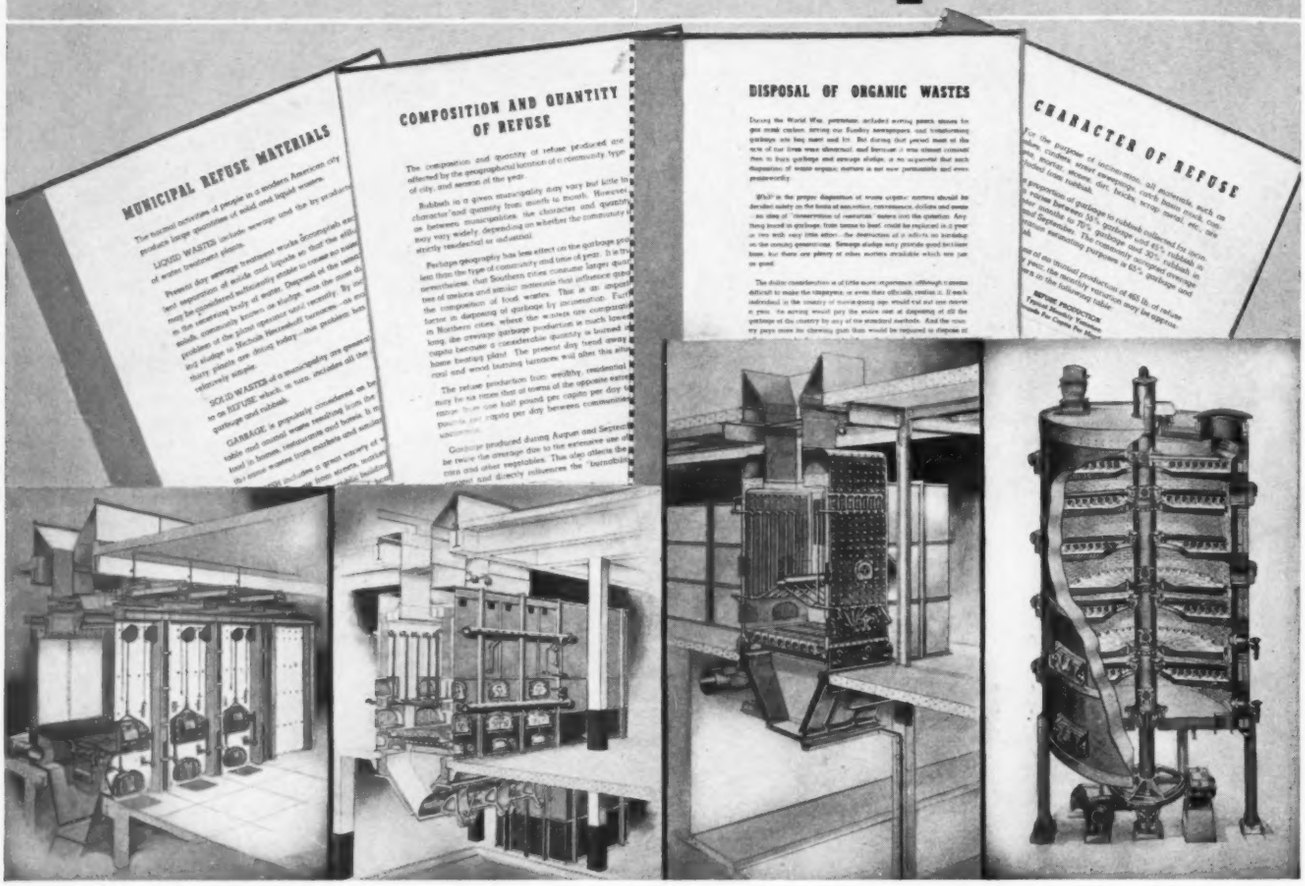
1. Controls corrosion.
2. Prevents precipitation of dissolved iron.
3. Stabilizes water following softening.
4. Prevents scale formation from hard, high-bicarbonate waters.

**Calgon is the registered trade-mark of Calgon, Inc. for its sodium metaphosphate products.*

Calgon, Inc., 300 Ross St., Pgh., Pa.
Gentlemen: Please send me free sample of Calgon ☐. Information on corrosion control ☐, stabilized water ☐, scale prevention ☐.

Name .....
Affiliation .....
Address .....
City ..... State .....

Incineration Headquarters



Nichols continuous grate unit with patented counter-balanced dumping grates and counter-weighted guillotine stoking doors.

Nichols insulated steel-encased refractory lined furnace with suspended basket grate. Ash hoppers and ash gate in tunnel below.

Nichols steel water-jacketed furnace with suspended drying basket. This is a steam producing unit.

Nichols 8-hearth mechanically rabbled furnace for reducing sewage sludge, screenings, grit or garbage to sterile ash.

Incinerators built by Nichols, whether for rubbish, garbage, grit or sewage sludge or any combination of these, offer large and small communities a sanitary, efficient and economical method of reducing to harmless mineral ash, all materials which might be dangerous and harmful or become a public nuisance.

Write "Incineration Headquarters for catalogs describing the Nichols Refuse Incinerators and the Nichols Herreshoff Incinerators for the disposal of Sewage Solids and Industrial Wastes.

NICHOLS

ENGINEERING & NERCO RESEARCH CORP.

60 WALL TOWER **NEW YORK, N. Y.**

CHLORINE ICE TROUBLES

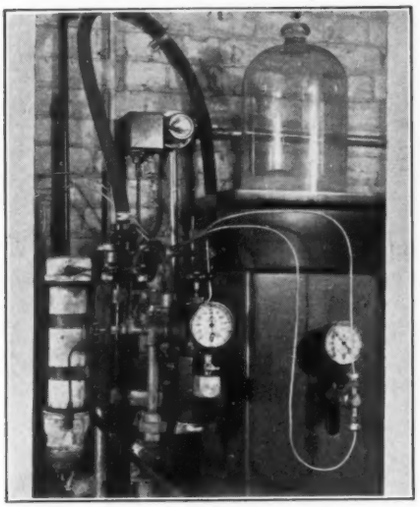
How We Licked This Problem

By DON CALDERWOOD
Engr., Pennichuck Water Works Co.,
NASHUA, N. H.

Dear "Doc":

Thanks a lot for your letter in WATER WORKS AND SEWERAGE describing your pipe-truck and derrick.* It sure is a corker and I hope that we will soon be able to fix up a derrick on our new platform truck. We considered ourselves lucky to get the O.K. for the new truck but now we will have to sell the "Big Boss" the idea for the derrick, and your enthusiastic letter will make our job easier.

I wonder if you have had trouble with chlorine hydrate—usually called chlorine ice—forming in your chlorinator? If so, you may be interested in hearing how we solved this problem.



Our First Heater
(O.K. Except Upside Down)

A few years ago we purchased a Wallace & Tiernan type MSVM chlorinator. The following winter we experienced our first real trouble with so-called chlorine ice. We built a wooden box over the bell jar and put electric lights in it; we tried a unit from a sun bowl heater inside the standard under the tray; and then a combination of both. These gave results after a fashion but did not do a real workmanlike job—so after three or four seasons of makeshift operation we set out to find a permanent solution to the problem. Like most water works operators we turned to our friends for suggestions.

Accordingly we backed the old jallopy out of the garage and headed due north to call on my old friend "Swede." And of all things—he had never seen chlorine ice! This was almost unbelievable since he obtains his water supply from a pond the same as we do. Investigation showed that he had about ½ mile of small size pipe passing through a hot basement before it arrived in his chlorinator room, so evidently it picked up enough heat from the warm cellar to keep the water always above 50° F., and naturally chlorine ice did not form.

As the day was still young, I next headed west to see Bob. He has a beautiful new boiler plant with oil burners and all the latest gadgets. One of these gadgets was an electric immersion heater to heat the oil when making a cold start. There was our answer—if it would heat oil, why not water?

We Purchase an Immersion Heater

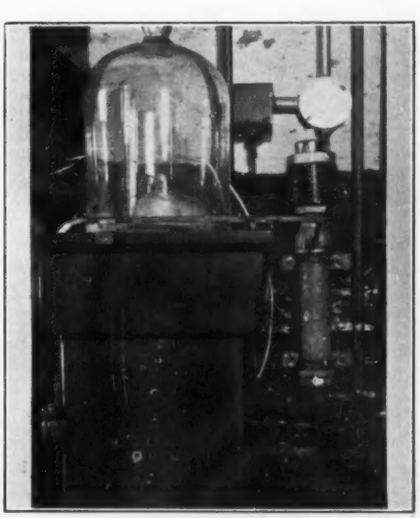
After returning home we purchased a 1500 watt immersion heater with a three heat switch giving us 500, 1,000, or 1,500 watts as needed. We then took a piece of 2½ inch pipe about 10 inches long, screwed a cap on one end, a reducing coupling on the other, and into the reducing coupling we screwed the 1,500 watt heater. We next tapped into the cap and coupling for ⅛ inch copper tubing and after fastening the assembled unit to the chlorinator we disconnected the water supply line to the tray and with copper tubing made new connections so that all the water going into the tray first passed through the heating unit. To elimnate the possibility of forgetting to turn the heat either on or off, we purchased a pressure switch and connected it to the water supply line in such a way that it automatically turns the current for the heating unit on when we turn on the water supply to the chlorinator, and also turns it off when the water pressure is shut off.

This scheme worked perfectly for about three winters and then a ground started to show on our switchboard. We traced it to the heater and found that in our zeal for efficiency and in our desire to utilize all the heat available we installed the heater with the electric connections pointing down. During the humid summer weather condensation from the outside of the pipe had run down on the electric connections finally causing the ground. We have now reversed the unit, putting the heater in from the top and expect no more trouble. We find that low heat, or 500 watts, is all the current we need to use except for a few days during the coldest part of the winter.

This heating unit worked so well that we decided to put one on the chlorinator in our other station even though we use that station very little in the cold weather. This chlorinator was an older model and did not have a separate valve and line for the tray water supply, so we connected the heater similar to the other installation but conveyed the warm water from the heater directly over the top and into the tray. The water supply was adjusted so that the water flowing through the heater and into the tray was just a little less than the required amount, the remainder being supplied in the usual way through the float valve in the tray supply line. Here are pictures of the original upside-down job and the trouble free improved job on the second chlorinator.

The "Big Boss" just came in and apparently is in excellent humor, so I'm going to try to sell him your idea for the derrick on our new truck. If the atmosphere gets too "chilly" in the next half hour I may have to turn on the full 1,500 watts.

Best of luck,
Don.



Our Second Heater
(With Automatic Cut-off.)

*See Feby. 1940 Issue—"Transportation," by D. R. Taylor.

The Editor's Comments

Rating Public Water Supplies

THERE is nothing more stimulative in turning out better products, attaining improved performance, or advancing quality of service than clean competition.

We more often associate competition with the selling of goods than in any other direction. However, there are many other forms of competition when considered in its broader conception. And, almost regardless of the activity or the undertaking, when competition is wholly lacking indifference, stagnation or retrogression is the result expected. In our dictionary competition is defined as "the act of contending for the same object." We would argue that this definition lacks breadth and believe that a more correct and inclusive definition for competition to be "the act of *striving* or contending for the same object or *objective*." To this writer's thinking the act of *striving for an objective* is competition of the higher order. It is the class of competition that counts for most in making this world a better place in which to live.

Consider cities and towns, like many another, we have often conjured in our mind as to just how differently many municipal utilities might have functioned in years gone by had there been at least some degree of competition to spur on department heads and operating personnel of municipally-operated plants. In this matter it has been observed that where cities are of medium size, and are located relatively close to one another, municipally-operated utilities have enjoyed a type of management of a more business-like character than has been observed in sections of the country where long distances separate communities. In this same direction it has been observed that where meetings of water-works managers have been held at frequent intervals, and at locations fairly readily reached by these department heads, and members of their staff, that a keener interest is exhibited in doing a job a "mite bit" better or more economically than Bill, Henry or Sam. These are three other managers who "Tom" has gotten to know and call by their first names, just because of such meetings. What is the answer? Basically it's competition—competition, as we would see it defined, in obtaining an objective and going enough beyond to enjoy the satisfaction of having done so. Perhaps of having set an example which others may benefit from, and in particular the water user, the taxpayer or the community as a whole.

As an example of when a progress making competitive spirit abounds most noticeably between waterworks superintendents and managers we cite the New England States. Here cities are close together and contacts are more frequent between neighbor superintendents attending the monthly or bi-monthly meetings of the three New England associations than prevails in any other section of the country. These associations are the New England Water Works Assn., the Maine Water Utilities Assn. and, the most recent, the New Hampshire Water Works Assn.

On the other hand it has been noted that where the competitive "spark-plug" of progressiveness is weakest is where distances separating communities is greatest and where opportunities for waterworks operators to attend meetings are least.

Another Method of Great Promise

Deserving consideration should be given another scheme which can but engender a status of competition in the municipal field of water supply. We believe the plan in question will go far in bringing about improved water works systems, a safer and more palatable water, dependability of supply, protection of the public; and, with it all, a higher type of operator and management generally. Therewith, a greater public appreciation of "what's behind the faucet" and what quality in operating personnel means to the community's No. 1 public asset—a safe, palatable and dependable water supply.

The procedure we refer to may be termed "The Rating Plan for Public Water Supplies." Something of this nature has been in use for several years in Texas. Annually the State Dept. of Health numerically grades and rates the public water supplies and systems of Texas cities and yearly awards certificates of recognition to those which have shown the greatest improvement in water quality or water service in general.

Now, we have but recently learned of a proposed "Rating Schedule for Public Water Supplies" being set up by the Tennessee State Dept. of Health. The plan was presented and discussed before the Kentucky-Tennessee Section of A.W.W.A. meeting last month in Lexington, Ky.

The most distinctive advantages to accrue from a General Water Supply Rating Plan, as we see it, is that of giving credit where credit is due; and, by the easily interpreted published numerical ratings to create amongst cities and towns that desirable spirit of striving for ratings of which the local Chamber of Commerce and other booster organizations of a community can be proud; or, least-wise, can see in published form without feeling uncomfortable over it. Then, too, it is frequently a difficult job for State Sanitary Engineers by technical arguments alone to bring home to contented commissioners of an indifferent administration that all is not as it might be with the local water supply or the system. In consequence only the correction of the indisputable hazards are insisted upon, and all others "recommended." Such matters are viewed as items which may be put off until "tomorrow" and too often "tomorrows" never come.

But, with a published list of communities, showing the standing of the water supply of each in the unmistakable terms of numerical ratings, it will not make good reading "at home" in some communities. In consequence, we suspect that the betterments planned for "next year" come along sooner—much sooner, we feel may be predicted. If the Mayor claims there is no money for the recommended improvements, we believe the civic organization of his town will point out "ways and means" to the City Fathers.

This plan and procedure of Rating of Public Water Supplies having been so carefully studied and at present standing the test of trial application in Tennessee deserves recognition as an experimental development of top-flight rank. We can think of no real substitute for it as a means of presenting an understandable picture of water supply conditions to the general public as well as city administrations. And this very pointedly includes the qualifications of operating personnel as well as the adequacy and dependability of facilities for purification and distribution.

It strikes us that there is no less validity for the Sanitary Rating of Public Water Supplies than there has been for Fire Service Ratings.

Water Works Reduces Cost 47%

Dosage before using Standard Silicate—
2 grains alum per gallon
Cost per million gallons, using alum alone $4.41
Dosage after using Standard Silicate—
1 gr. / gal. alum and .3 gr. / gal. Standard Silicate
Cost per million gallons, using alum plus silicate . . . $2.34
SAVINGS $2.07

Source of Water Supply—
Surface water from nearby creeks collected in reservoir holding six months' supply.
Average Turbidity—
30-50 **pH**—7.7
Daily capacity—
Five Million Gallons.

In addition to the lower cost, larger flocs and longer filter runs were obtained. This is not an unusual record. It represents the savings possible through the use of Standard Silicate in your plant. Why not fill out coupon below and we will gladly send you further information.

DIAMOND ALKALI COMPANY • Standard Silicate Division

Plants at CINCINNATI · JERSEY CITY
LOCKPORT, N.Y. MARSEILLES, ILL.

General Offices • PITTSBURGH, PA.

TEAR OFF AND MAIL

Standard Silicate Division, Diamond Alkali Company, Oliver Building, Pittsburgh, Pa.

Our water supply has the following characteristics:

.....**Million Gallons per Day** **Average Turbidity** ..... **Present Dosage**....**gr./gal.** **Coagulant**.....

We would be glad to receive further information on the use of Standard Silicate.

Name..... **Title**.....

Water Works ..... **City**..... **State**.....

W-4

GAS HOLDERS by P.DM

MODERN, DEPENDABLE UNITS FOR EFFICIENTLY HANDLING DIGESTER GAS IN MUNICIPAL SEWAGE DISPOSAL

P·DM's long experience in designing, fabricating and erecting Gas Holders for municipal service is your best assurance of getting the ideal unit for your community's particular requirements . . . in type, materials and performance. • Let a P·DM Engineer check into your problem, and show you the right answer in terms of *guaranteed satisfaction!*

PITTSBURGH · DES MOINES STEEL COMPANY
Pittsburgh, Pa. . . . 3418 Neville Island
Des Moines, Ia. . . . . 919 Tuttle Street

The Dry Chemical Feeder *That's Built to Last*

INFILCO Type D Dry Chemical Feeders are built to perform with their original accuracy and dependability year after year. Two have been in continuous service at Louisville, Ky., for 15 years—And more trouble-free years are ahead, too, for Infilco Feeders are *built* for long life.

Their exclusive principle of operation permits simplicity in design and durability in construction, contributing to long, dependable service.

ECONOMICAL

Long life, without costly repairs and replacements, means *economical* operation. It pays to buy Infilco Type D Feeders for long-time economy.

Write for Bulletin 205-A.

INTERNATIONAL FILTER CO.
325 W. 25th Place, Chicago, Illinois
INFILCO

MEETINGS SCHEDULED

Nov. 13-15—OMAHA, NEB. (Fontenelle Hotel)
Missouri Valley Section A.W.W.A. Sec'y.-Treas., E. L. Waterman, Univ. of Iowa, Iowa City, Ia.
803 Water Board Bldg., Detroit, Mich.

Dec. 2-5—NEW YORK, N. Y. (Hotel Astor)
American Society of Mechanical Engineers. National Secretary, C. E. Davies, 29 W. 39th St., New York, N. Y.

Dec. 12—MEXICO, ME.
Maine Water Utilities Association. Sec'y.-Treas., Earle A. Tarr, Winthrop, Me.

Dec. 27, 1940—NEW YORK CITY, N. Y. (Commodore Hotel)
New York Section A.W.W.A. (Winter Get-Together Luncheon) Sec'y., Rollo K. Blanchard, 50 West 50th St., New York, N. Y.

Jan. 15-17—NEW YORK CITY, N. Y. (Engineering Societies Building)
American Society Civil Engineers. Annual Meeting. Sec'y., George T. Seabury, 33 West 39th Street, New York City.
(Jan. 16—Sessions of Sanitary Engineering Division)
(Jan. 17—Joint Dinner of the Division and N. Y. Sewage Works Ass'n.)

Jan. 17-18—NEW YORK CITY, N. Y. (Hotel McAlpin)
New York State Sewage Works Ass'n. Sec'y., A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 17—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 18—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Jan. 23—NEW YORK CITY, N. Y. (Engineering Societies Building)
American Society of Mechanical Engineers. (Evening Meeting Sanitation Group) Chairman, Wm. Raisch, Consulting Engineer, 227 Fulton St., New York, N. Y.

March 20-21—TRENTON, N. J. (Stacy-Trent Hotel)
New Jersey Sewage Works Ass'n. (26th Annual Meeting) Treas., Paul Molitor, Jr., Box 374, Morristown, N. J.

June 22-26—(1941)—TORONTO, ONT. (Royal York Hotel)
American Water Works Association. Annual Convention. Secretary, Harry E. Jordan, 22 E. 40th St., New York, N. Y.

LITERATURE AND CATALOGS

Water Works Specialties and Supplies—By Northrop & Co. While the name Northrop has long been associated with a well known pipe jointing compound, few realized until the recent appearance of an impressive catalog of 48 pages that Northrop & Co. of New York City has established so complete a line of "Water Works Supplies and Specialties" as appears, effectively illustrated, in the first Northrop Catalog. In glancing through this issue are found Crispin Air Valves and Slip Joints; Marlow Pumps (5 pages of them); Giant Pipe Pushers; Gifford Electrical Thawing Machines; the Globe Line of Pipe Finders, Geophones, Valve Locators, etc. Northrop's Hydrant Testing Pressure and Flow Gauges; U. S. Pressure Gauges; Schramm & "Fordaire" Compressors (6 pages of them); Clark Metering Equipment & Accessories (4 pages); Brainard's famed "Meter Masters"; Northrop's inexpensive fire line "Flow-O-Meters"; Clinton Packings, etc. So there is much to look at—much to know about—in Northrop's Catalog now in its First Edition. For a copy, write Northrop & Co., 50 Church St., New York City.

"ISCO" Ferric Chloride—Is the subject of a new and comprehensive 16-page illustrated brochure from Innis, Speiden & Co. of New York. In reality it constitutes a Handbook on Ferric Chloride. In the foreword the reason for this booklet is stated as being "for the purpose of bringing suggestions of value in helping solve many questions which may arise in the handling and use of this highly active coagulant. The practices described are the result of everyday experience, and the technical data are derived from the most reliable and accurate sources." The opening chapter reveals the present status and adaptations of ferric chloride as a coagulant for sewage, industrial wastes and sludges. Then follows "Chemical and Physical Characteristics" of the chemical; "Methods of Handling, Dissolving and Testing and Feeding." Incorporated are useful tables, conversion factors and graphs and, also, a "Method of Determining Correct Dosages of Ferric Chloride." For a copy of this very useful "Ferric Chloride Handbook," write Innis, Speiden & Co.,, 117 Liberty St., New York City.

The New Skinner Catalog—Might best be described as a combination of catalog and "Pipe Repair Manual," so complete in data and illustrations is the new 40-page production of M. B. Skinner Co. of South Bend, Indiana. Besides the well known Skinner Repair Clamps and Service Fittings, this catalog includes several new "Skinner-Seal" items not previously cataloged—such being the Non-Shift Service Saddle, Bull-Neck Street Tee, Forged Welding Tee, Welding Tube, and various Drilling Devices, Cutters and Adapters. A series of valuable tables show the ten most widely used Service Methods, with data on equipment recommended for various sizes of tees, saddle outlets, pipe nipples, and tubes.

With handsome cellophane plated cover and plastic binding, this new catalog represents a costly as well as thorough production, which every water works superintendent should be interested in possessing and studying. For a copy of Catalog No. 41, write M. B. Skinner Co., South Bend, Indiana.

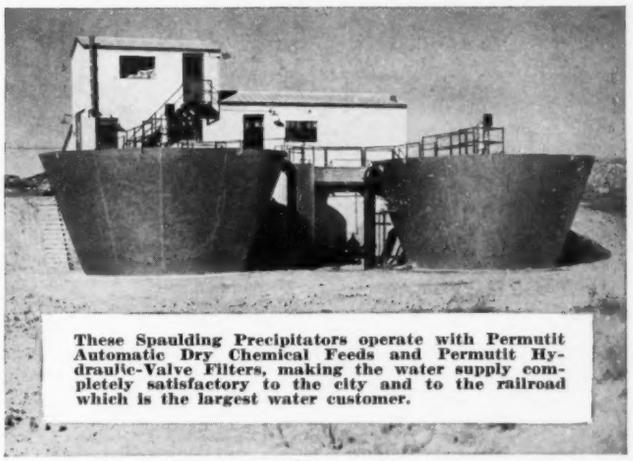
"Lin-Tite" Coatings—Are the subject of a 24-page brochure from Linings, Inc., of Chicago, which explains the application of protective coatings to metal, concrete walls, floors, wood, etc. It presents the properties and distinctive characteristics of "Lin-Tite" primers, paints and coatings; the rubber-like "Lin-Tite" Linings, for tanks holding chemical solution; "Lin-Alume" as a coating for walls subjected to moisture, condensation water, splash or spray. In the closing paragraph is the challenge—"Submit your toughest problem to us without obligation." For a copy of this brochure, which also contains specimens of "Lin-Tite" coatings and linings, write Linings, Inc., 914 South Wabash Ave., Chicago.

Aluminum Gratings with interlocking bridges and non-slip surface are described with diagrams, sections, and a table of safe loads by spans in Folder G-1 issued by the H. J. Thelen Bronze Co., Inc., 118 Sandford St., Brooklyn, N. Y. Other aluminum and silicon bronze products such as slide gates, weir plates, bar screens, baffle boxes, scum troughs, parshall flume livers, wet well float cages, screens and screen frames are listed but not described in detail in this folder.

Pipe Thawing, though not stressed in the circular describing the new Hobart Jr. Welder, is an important use for this machine. Two hundred ampere capacity; gasoline engine drive (132.7 cu. in. displacement, 1500 r.p.m. operating speed); self-starter; separate exciter;

Gallup, N. M. Solves Hard-Water Problem with "PERMUTIT"* SPAULDING PRECIPITATORS

* Trademark Reg. U. S. Pat. Off.

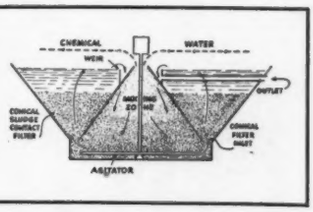


These Spaulding Precipitators operate with Permutit Automatic Dry Chemical Feeds and Permutit Hydraulic-Valve Filters, making the water supply completely satisfactory to the city and to the railroad which is the largest water customer.

Million-Gallon Units Soften 23-Grain Water

Gallup, New Mexico, is just one of the many up-to-date municipalities that have installed Spaulding Precipitators within the last two years. The trend is to this new type of Cold Lime Treatment because of its unusual ease and economy of operation and its flexibility of design.

This cross-section shows how the Spaulding Precipitator operates. Sludge is kept in constant suspension by agitator. Old sludge mixes with newly forming sludge, speeds precipitation and acts as contact filter. Conical shape of chamber lowers velocity of rising water. Sludge drops out, leaving effluent sparkling clear.



For further information and free booklets on Spaulding Precipitators, Zeolite Water Softeners, Iron Removal plants and other automatic accessory equipment, write The Permutit Company, Dept. G1, 330 West 42nd Street, New York.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

LOCK JOINT REINFORCED CONCRETE PIPE
LOCK JOINT PIPE CO., Established 1905 AMPERE, N. J.
PRESSURE • SUBAQUEOUS • SEWER • CULVERT

Economy Dictates
DOW
Sludge Conditioning
FERRIC
Sewage Coagulation
CHLORIDE
Water Purification

35-45% Solution — Shipped in Tank Cars
60% Crystals — Packed in 300 or 500 lb. Barrels

For quotations and complete technical information, write today.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

extra brush capacity; and streamlined design are among the features stressed by the manufacturer. A request to Hobart Brothers Company, Troy, Ohio, will bring this circular and other descriptive matter.

Turbine Pumps, Water Lubricated, with Open Impellers are the subject of Bulletin 6930R, issued late in September by Fairbanks, Morse & Co., Department 133, 600 S. Michigan Ave., Chicago, Ill. A detailed and exceedingly clear, full length sectional view, with explanatory notations, dominates the folder. Outside views and a brief text are included.

"Automatic Controls for Water and Sewage Pumps" are presented in a comprehensive revised 1940 edition of the earlier published bulletins from Automatic Control Co. of St. Paul, Minn. The revised bulletins, now bound in a single filing catalog, are devoted to "Tanktrols" for pump control in connection with elevated tanks or reservoirs; "Floatrols" which are multicircuit float switch controls for sequence operation of pumps; "Selectrols" for program operations of two or more pumps in sewerage systems; "Duotrols" for automatic operation and balance between air and water ratio in connection with pnuematic tanks; Float Switches and Accessories for the several systems. If your file has not the 1940 revision of Automatic Control units, it should be brought up to date by requesting 1940 Catalog C-3 from Automatic Control Co., 1005 University Ave., St. Paul, Minn.

Gratings and Stair Treads—Are presented in a new Klemp Catalog which describes Diamond Grating, Steel Stair Treads, Hexteel Heavy Duty Surface Armor, and Klemp-Acme Floorsteel, with tables of safe loads, and information on assembly and recommended fillers. The catalog is completely illustrated with photographs and diagrams showing the various services and methods of using Klemp products. A copy may be obtained by writing to Wm. F. Klemp Co., 6601 South Melvina Ave., Chicago.

"Lessons in Arc Welding" is a series of 51 lessons, based upon experiences of Arthur Madson, instructor of The Lincoln Arc Welding School, presenting in concise manner fundamental facts of welding, knowledge of which will enable the welder to utilize the welding process successfully and economically. Following introductory notes and instructions, are 19 lessons in the use of unshielded arc electrodes, 9 lessons in the use of shielded arc electrodes, 15 lessons on particular joints and metals, and 8 lessons on hard facing. Published by The Lincoln Electric Co., Cleveland, Ohio. 144 pages, 6 x 9 inches; over 100 illustrations, including photos and drawings; cover—semi-flexible simulated leather, gold embossed. Price is 50 cents per copy, postage prepaid anywhere in U. S. A. Elsewhere 75 cents.

Waterproofing and Dampproofing Compounds for almost every purpose are covered in the catalog and price list recently received from Ranetite Manufacturing Co., Inc., 1917 S. Broadway, St. Louis, Mo. Twenty-nine products in all—each designed for a particular class of work—are described and priced. The catalog treatment is attractive, convenient and unusual.

Recent Improvements in Trenching Machines of Both Wheel and Boom Types are described in Bulletin 46, a well-illustrated folder received recently from The Buckeye Traction Ditcher Co. of Findlay, Ohio.

V-Type Heat Recirculator for use in large buildings, such as warehouses, garages, stores, offices, auditoriums, factories, and plants of various sorts are described in a folder from Kisco Company, Inc., 39th St. at Chouteau Ave., St. Louis, Mo. Like a "unit heater" in general principle, the V-type unit but does so with only one motor, one fan and one projects warm air in two directions instead of one, set of inlet and outlet connections.

"Fire Guns—by Hauck"—are described as "utility torches for 101 uses." They are portable outfits, much like a one-man insecticide sprayer (2 to 4 gals.) slung from the shoulder; the nozzle is the torch. The powerful smokeless flame is "windproof" and the outfit is employed as a general thawing device in winter and more prevalently as a weed destructor in summer. The fuel is kerosene oil or gasoline, as preferred. Additional applications include thawing of piles of gravel, sand, etc., hydrants, valves and sluice gates, manhole covers; drying concrete walls before water proofing; removing dust and tubercules, old paint, etc.; sterilization of infected areas. For a copy of Hauck's Fire Gun Bul. No. 1034, write Hauck Mfg. Co., 124 Tenth St., Brooklyn, N. Y.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Water Works and Sewerage, published Monthly at Chicago, Illinois, for October 1, 1940.

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edward S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Water Works and Sewerage and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Gillette Publishing Co., 330 So. Wells St., Chicago, Ill.

Editor—L. H. Enslow, 155 E. 44th St., New York, N. Y.

Managing Editor—John Cecil Black, 330 So. Wells St., Chicago, Ill.

Business Manager—Edward S. Gillette, 330 So. Wells St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Gillette Publishing Co., 330 So. Wells St., Chicago, Ill.

H. P. Gillette, 330 So. Wells St., Chicago, Ill.

Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.

Mrs. R. W. Hume, 303 S. Stone Ave., La Grange, Ill.

Provident Trust Company, 17th and Chestnut Sts., Philadelphia, Pa.

Louise Forsythe, 13 E. Windemere Terrace, Lansdowne, Pa.

La Verne Louer Hellyer, Ambassador Hotel, Chicago, Ill.

L. H. Enslow, 155 E. 44th St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is —. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 9th day of October, 1940.
(Seal) KITTIE C. WOULFE,
Notary Public.
(My commission expires Feb. 8, 1942.)

26,618,347

PEOPLE IN ALL 25 OF THE LARGEST CITIES OF THE UNITED STATES ARE SERVED BY WATER WORKS USING-

BUILDERS Venturi Meters

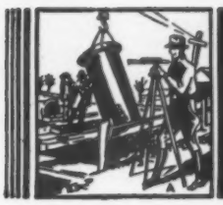
Many millions more in smaller cities and towns are equally well served!

- ☐ Bulletin 318 Flo-Watch Meter
- ☐ Bulletin 320 Chronoflo Meters
- ☐ Bulletin 324 Type M Venturi Meters

Check the Bulletins you want and ask us for a copy; address

BUILDERS IRON FOUNDRY, PROVIDENCE RHODE ISLAND

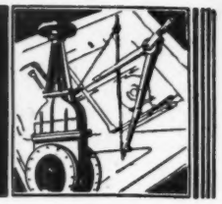
"QUALITY A TRADITION FOR OVER 100 YEARS"



Consulting Engineers

Specializing in the field of

WATER WORKS & SEWERAGE



Albright & Friel, Inc.
Consulting Engineers

Water, Sewerage, Industrial Waste, Garbage, Power Plant and Valuation Problems.

1520 Locust St.
Philadelphia, Penn.

Alvord, Burdick & Howson
Engineers

John W. Alvord
Charles B. Burdick
Louis R. Howson
Donald H. Maxwell

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building **Chicago**

Black & Veatch
Consulting Engineers
4706 Broadway, Kansas City, Mo.

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations, Reports and Laboratory Service

E. B. Black — N. T. Veatch, Jr.
A. P. Learned — H. F. Lutz
F. M. Veatch — R. E. Lawrence
E. L. Filby

Buck, Seifert and Jost
Consulting Engineers
(Formerly Nicholas S. Hill Associates)

Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation, Management, Chemical and Biological Laboratories.

112 East 19th St. **New York**

Burns & McDonnell
Engineering Co.
McDONNELL-SMITH-BALDWIN-TIMANUS-McDONNELL
Consulting Engineers Since 1897

Waterworks, Light and Power, Sewerage, Reports, Designs, Appraisals, Rate Investigations

Kansas City, Mo., 107 West Linwood Blvd.
Cincinnati, Ohio, 307 East Fourth St.
Albany, N. Y., 11 North Pearl St.

The Chester Engineers
Campbell, Davis & Banksor.

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications

Investigations, Appraisals, Rates, Testimony, Design, Supervision, Operation, Accounting

210 Parkway at Sandusky Street
Pittsburgh, Pa.

This Service Is Available to All

CONSULTING ENGINEERS

This Directory is used by the readers when seeking names and addresses of Consulting Engineers. Be sure your professional card is listed. Rates nominal. For particulars write—

Water Works & Sewerage
330 S. Wells St., Chicago

Edward A. Fulton
Consulting Engineer

Investigations, Reports, Valuations, Design and Construction—Water Supply and Purification Plants, Sewerage and Sewage Treatment Works; Municipal Paving and Power Developments.

3 So. Meramac Ave.
St. Louis, Mo.

Greeley & Hansen
Hydraulic and Sanitary Engineers

Investigations and Reports. Plans and Specifications, Supervision of Construction. Supervision of Operation. Water Supply and Purification, Sewerage and Sewage Disposal, Garbage Collection and Disposal, Appraisals.

6 N. Michigan Avenue, Chicago, Ill.

Havens and Emerson
(formerly Gascoigne & Associates)

W. L. Havens **C. A. Emerson**
A. A. Burger **F. C. Tolles** **F. W. Jones**
Consulting Engineers

Water, Sewage, Garbage, Industrial Wastes, Valuations. — Laboratories

Leader Building, Cleveland **Woolworth Bldg., New York**

Morris Knowles, Inc.
Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning.

Pittsburgh, Pa.

Lancaster Research Laboratories

Physical and chemical tests of Sewages, Sludges and Industrial Wastes.
Examinations, tests and reports on treatment processes and equipment. Experts in litigation.
Treatment processes for Industrial Wastes.

85 Zabriskie Street
Hackensack, New Jersey
Hackensack 3-2325

Metcalf & Eddy
Engineers

Water, Sewage, Drainage, Garbage and Industrial Wastes Problems
Laboratories — Valuations

Statler Building
Boston, Mass.

Reeves Newsom
Engineer-Consultant

WATER WORKS—SEWERAGE

Construction and Operation
Investigation and Design
Valuation and Rates

500 Fifth Ave., New York **Telegraph Building, Harrisburg**

Nussbaumer & Clarke, Inc.
Newell L. Nussbaumer **Irving Clarke**

Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning

327 Franklin St. **Buffalo, N. Y.**

Malcolm Pirnie
Engineers

Water Supply, Treatment, Sewerage
Reports, Plans, Estimates
Supervision and Operation
Valuation and Rates

25 W. 43rd St., New York, N. Y.

The Pitometer Company
Engineers

Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies.

Penstock Gaugings
New York, 40 Church St.

William Raisch and Associates
Consulting Engineers

Sewage Treatment, Refuse Disposal, Sewers, Drainage, Reports

227 Fulton Street **New York, N. Y.**

George S. Rawlins
Consulting Engineer
Structures — Water Works
Drainage — Sewerage Works
507 Builders Building
Charlotte, N. C.

Russell & Axon
Geo. S. Russell—John C. Pritchard
Joe Williamson, Jr.—F. E. Wenger
Consulting Engineers, Inc.
Sewerage, Sewage, Disposal, Water Works, Filtration, Softening, Power Plants
4903 Delmar Blvd. **St. Louis, Mo.**

Weston & Sampson
Robert Spurr Weston **George A. Sampson**
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service, Supervision, Valuations.
14 Beacon St. **Boston, Mass.**

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification, Sewage Treatment, Operating Supervision of Plants, Sanitary Surveys, Stream Pollution Investigation, Swimming Pool Control. Chemical and Bacteriological Analyses, Testing of Materials.
369 East 149th Street, New York City
(Tel. Melrose 5-6579)

Stanley Engineering Company
Water Works — Sewerage
Electric Power
Reports — Design
Supervision — Valuation
Central State Bank Bldg., Muscatine, Ia.

Whitman & Howard
Harry W. Clark, Associate
(Engineers (Est. 1869—Inc. 1924)
Channing Howard — Paul F. Howard
Walter A. Janvrin — C. Roger Pearson
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

Runyon & Carey
Consulting Engineers
Water Supply and Treatment, Sewerage and Treatment, Power Plants, Heating and Ventilation, Electric Lighting.
33 Fulton St., Newark, N. J.

Water Leak Detector Co.
Engineers
Pipe Line Location Maps
Water Leak Detector Instruments
Pipe Locators
166 N. Third St. **Columbus, Ohio**

Whitman, Requardt & Smith
Engineers
Ezra B. Whitman — Norman D. Kenney
Gustav J. Requardt — A. Russell Vollmer
Benjamin L. Smith — Theodore W. Hacker
Water Works — Sewerage Utilities
Baltimore, Md. **Albany, N. Y.**

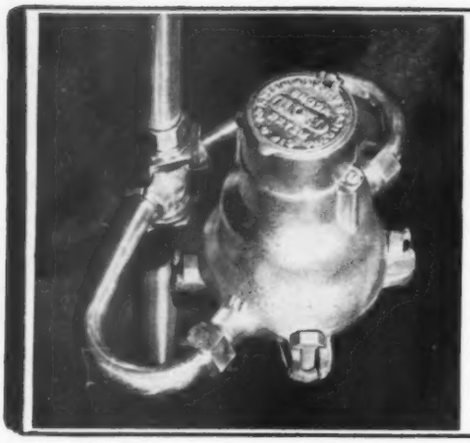
Today—Simplex Sand Expansion Indicators are insuring wash water savings and greater efficiency of filtration in large and small—new and old—plants.

In plants whose capacities are as low as 1 m.g.d. and as great as 30 m.g.d. SIMPLEX SAND EXPANSION INDICATORS are proving their worth as an aid in securing proper filter washing. Longer filter runs and reduction in wash water usage are resulting in noteworthy savings. Let us show *you* how this inexpensive device will help you in reducing *your* operating costs.

•

Write for Data

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET • PHILADELPHIA, PA.



The FORD COPPERHORN

Permits installation of water meters at correct height in vertical basement pipes. Saves meter couplings, pipe fittings, joints, and labor. All copper and brass.

Connects and supports piping, making meter changes trouble-free. Provides better flow through meter, and permanent electrical bond for service.

ASK FOR INFORMATION AND SAMPLE

FORD METER BOX CO.

WABASH, INDIANA

INQUIRIES INVITED on all Problems of Water Treatment

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO.

607 COLUMBIA AVE DARBY, PA.

JOSEPH G. POLLARD CO., INC.
151 ASHLAND PLACE, BROOKLYN, N. Y.

Use P F T Equipment in Your Sewage Treatment Plant

Write for Latest Bulletins

PACIFIC FLUSH TANK COMPANY

Designers & Manufacturers of Sewerage and Sewage Treatment Equipment

4241 Ravenswood Ave. Chicago, Ill.

EXCLUSIVELY SINCE 1893

441 Lexington Ave. New York, N. Y.

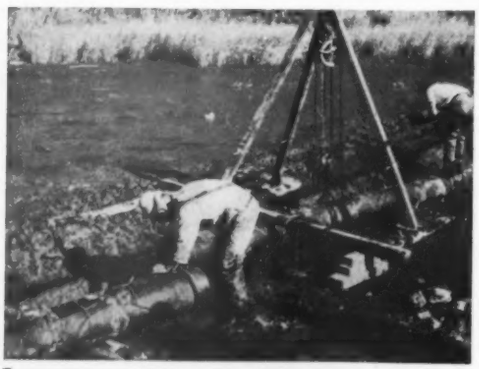
Cut Coagulant Costs with

FERRIC SULPHATE is a coagulant for all types of Water Treatment. Also adaptable for Waste Water Treatment. Save by conditioning sludge with ferri-floc. Atlanta's Clayton plant uses ferri-floc alone. (No lime required to condition this sludge.) Send for free literature and sample to test in your plant.

Ferri-Floc — TC — FERRIC SULPHATE

TENNESSEE CORPORATION

ATLANTA, GA. LOCKLAND, OHIO



10" Armored Mono-Cast Doublex Simplex Pipe being installed alongside main line of N. Y. Central Railroad about ½ mile north of Croton-on-Hudson Station.

10" ARMORED MONO-CAST DOUBLEX SIMPLEX PIPE INSTALLED IN VERY CORROSIVE SOIL

AN IMPRESSIVE example of how Armored Mono-Cast Centrifugal Pipe is being used to assure longest life and lowest maintenance cost in locations where soil is excessively corrosive, is this installation in New York State, where the pipe was laid in brackish muck. Pipe previously laid in this location lasted only a few years, but engineers predict that this Armored pipe will give trouble-free service for many decades. Write for literature on this important Acipco development.

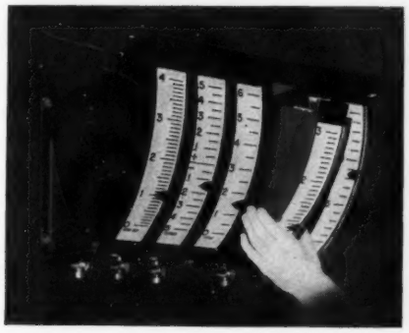
AMERICAN CAST IRON PIPE CO.

BIRMINGHAM, ALA.

New York City Chicago Cleveland Kansas City
Minneapolis Dallas Pittsburgh Los Angeles San Francisco

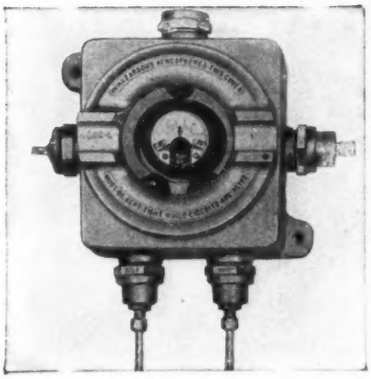
EQUIPMENT NEWS

New Multi-Point Indicator



● For indicating drafts, pressures, differentials, and other factors in boiler and industrial furnace operation, a new Republic multi-point indicator has just been placed on the market. Zero adjustments and all piping connections for each gauge unit are accessible from the front of the panel and each unit is designed to be withdrawn, like a book from a shelf, without disturbing other units. Each gauge is actuated by a very sensitive dry-bellows type of diaphragm for ranges from 0 to 50 inches of water or by a helical element for pressures above 50 inches of water. The gauges have 12-inch vertical, translucent, rear-illuminated scales. The new indicator is supplied with from 2 to 16 of these compact, interchangeable gauge units, and is built for either flush or projected mounting. It is described in detail in Bulletin No. 801, just issued by Republic Flow Meters Co., Chicago, Illinois.

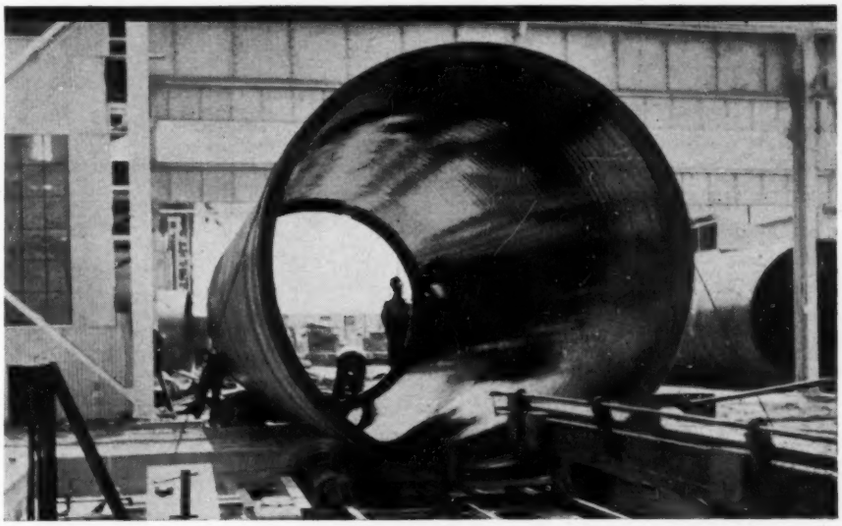
New Gas Alarm



● The new M.S.A. Explosion-proof Combustible Gas Alarm for safety *continuously* samples atmospheres where combustible gases and vapors may be present. The unit provides instant warning by sounding an alarm when gas concentrations exceed a predetermined limit. The unit may also be adapted to operate automatic ventilation equipment or to shut down electric motors, when there is danger of explosion or gas poisoning.

The M.S.A. Combustible Gas Alarm, including sampling pump, is contained in an underwriters' approved explosion-proof condulet. That the complete unit can be safely installed in gaseous atmospheres, thus eliminating the need for long sampling lines, is a distinctive advantage, adding dependability to the system. The instrument is specifically calibrated for the particular gas or vapor which it will test, and the compact unit (here pictured) measures but 7 x 6½ x 3 5/10 inches overall. Of added interest, the new instrument is priced considerably below earlier models of gas alarm units.

Details of construction and operation are fully explained in Bulletin DT-2 of particular interest to sewage works operators and designing engineers. Copies may be secured by writing Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.



WATER WORKS PIPE AND CONDUITS
Made Safe From *Rust and Corrosion*

REILLY PRIMER and PIPE ENAMEL have successfully withstood every test of dependability in the laboratory and in service. These coatings bond firmly to inner and outer surfaces of steel and cast iron pipes, conduits and tanks, providing a hard, smooth, elastic protective coat which neither moisture nor soil acids can penetrate. They withstand wide temperature variation without sag, chipping or peeling, and are highly resistant to abrasion. Inner surfaces of pipes remain free from tuberculation and permanent full flow is assured.

FREE BOOK ON REQUEST
Gives information about the characteristics and specifications of the various REILLY coatings, and application procedure. Illustrated with many views of coating methods and installations. Interesting and informative.

REILLY TAR & CHEMICAL CORP.
INDIANAPOLIS, INDIANA

***Reilly* PRIMER AND PIPE ENAMEL**

SALESMAN ON HIS WAY

. . . . to mail W. B. Carter's order for 325,000 lbs. of *Tegul*-MINERALEAD! For *what?* Why for that big Wichita, Kansas, 33-mile pipe line job you've been reading so much about.

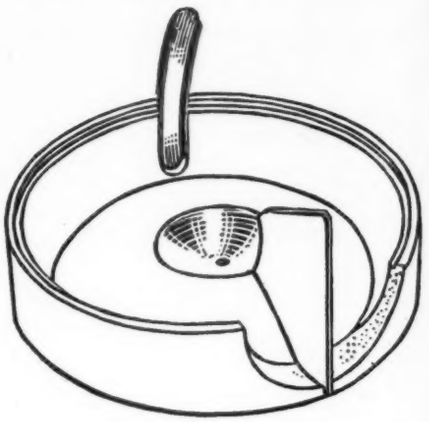
What *of* it? Turn to pages 536B-536C and get a load of information on how *good* jointing compound works.

Slot Inserts for Meter Chambers

● The Memphis Slot Insert is a simple but clever little device for prolonging the life of the measuring chamber of water meters. It is the invention of C. M. McCord, Director of Water at Memphis, Tenn.

The little insert is of wear resistant and corrosion-proof stainless steel. It is fitted into the thrust-roller slot of the hard rubber measuring chamber, as illustrated above. Thus a new and perfect roller track of long life is provided where old ragged slot chambers need not be scrapped. With each insert a new bronze thrust roller is supplied to insure the perfect performance. This combination will convert noisy or sticking meters into quiet self-starters, by eliminating the trouble-making joint of the measuring chamber.

At the present time Memphis Slot Inserts and thrust rollers are available only for ⅝″ meters, but larger sizes are soon to be produced. Considering the fact that these inserts are claimed by their inventor to extend the useful life of measuring chambers indefinitely and return damaged slot chambers to continued service, the quoted cost would seem to justify their adaptation extensively. Since samples are offered at no charge for Neptune, Pittsburgh, Worthington or Badger meters, water works operators would seemingly do well to request the descriptive folder



and a trial insert and roller from the Meter Specialty Co., 332 North 7th street, Memphis, Tenn.

$1,000.00

FOR WATER WORKS SUPERINTENDENTS, ENGINEERS AND CONTRACTORS

CLOW-NATIONAL announces the $1,000.00 "A Better Pipe Economy" CONTEST

Write for completely informative Contest Folder to:—

Mr. Frank J. Egan, Manager Cast Iron Pipe & Foundry Dept.

JAMES B. CLOW & SONS
201-299 No. Talman Avenue
CHICAGO, ILLINOIS

New Oxweld Regulators

● The Linde Air Products Company* announces the addition of two new single-stage, general service oxygen and acetylene regulators to its Oxweld line of welding and cutting apparatus. These regulators, the Oxweld R-80 oxygen regulator (left above) for the delivery of oxygen at working pressures up to 200 lb. per square inch, and the Oxweld R-81, its companion acetylene regulator (right above) feature simplicity of design and reliability of operation. They are strongly built and are designed to give completely dependable performance in all welding, cutting, and deseaming operations.

The R-80 and R-81 regulators are of the stem type—that is, the valve closes with the incoming pressure, thus assuring positive seating action. The materials used for the valve seats are selected for efficient service and long life. The passageways are of sufficient size to permit unrestricted flow of gases. In addition, the R-80 oxygen regulator has a special inlet screen formed of a double thickness of fine mesh to filter out dirt and foreign particles. Since the R-80 and R-81 have only a few working parts, the occasional maintenance which may be required can be performed quickly and inexpensively.

For additional details write the Lindi Air Products Co.,* 30 East 42nd St., New York City.

*A unit of Union Carbide and Carbon. Corpn.

From Silk Stockings to Sewage Treatment

We learn that DuPont has gone in for sewage treatment as well as silk stockings.

In this we refer to the adaptation of the synthetic plastic NYLON, for which ladies are willing to pay $1.65 a pair, to the production of bristles now successfully and economically employed in rotary brushes used for cleansing fine screens in sewage treatment plants.

These brushes, which sweep across the filter screen, operate continuously in water and are subject to the action of distillate oil for cutting grease from the brushes. Even the heaviest imported bristles employed have to be replaced within a year, as a rule.

Nylon as bristling material was first tried on Milwaukee's fine screening plant, one of the largest in the country. A set of eight Nylon-bristled brushes, each 18 inches wide and requiring five pounds of bristling material, was installed there in March, 1939. Eighteen months later they were still functioning as well as ever.

Engineers of the Milwaukee Sewage Commission computed the wearing rate of Nylon brushes at 1/16 of an inch a year. They found that the imported hog bristles, previously used, wore down four times as fast. The average life of hog bristles in this plant was 6,500 hours of running time. After 5,100 hours, the Nylon brushes showed but little signs of wear.

Hog bristles had been wearing thin at the tips soon after installation. This has sharply reduced their original stiffness and cleaning ability. Nylon, being a non-capillary material, wore straight across.

It was found that oils and greases had no effect upon Nylon, which is resistant to most industrial chemicals. Nylon also resists the softening effect of continuous immersion in water, absorbing only a fifth as much water as hog bristles.

Although the price is still higher than that of cheaper grade natural bristle the final cost is lower, due to savings on replacements and the ability of Nylon to resist the softening effects of kerosene oil used in removing grease from the brushes.

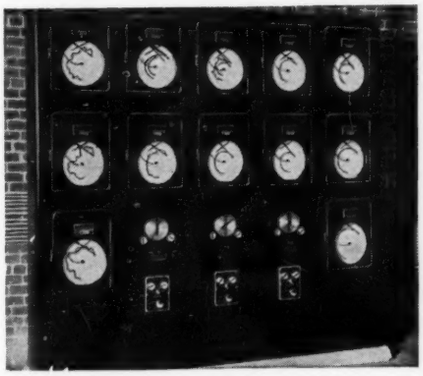
Nylon bristles are manufactured by the DuPont Plastics Department at Arlington, N. J., which supplies brush manufacturers. The brushes for the Milwaukee plant were produced by the Schaefer Brush Manufacturing Co., of that city.

THE *Bailey Synchro-Meter* GIVES YOU *Flexibility* IN METERING APPLICATIONS

● This meter panel includes both direct mechanically operated Fluid Meters and Bailey Synchro-Meters, which are electrically operated by remote transmitters.

Wherever you have need for a central meter panel incorporating both mechanically and electrically operated Fluid Meters, it is possible to maintain uniformity and neatness by employing this system of transmitting meter and recorder readings.

MU-17



Readings of flow, pressure, temperature, liquid level and other factors are accurately and quickly transmitted from out-of-the-way places to the receiving indicator, recorder or integrator by the Bailey Synchro-Meter.

This electrical mechanism which is completely described and illustrated in Bulletin No. 194-A, can also be used to eliminate the necessity of running high pressure piping up to meter and control panels.

Write for your copy of this new Bulletin.

BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL

RUSTA RESTOR

An effective and low cost method of preventing corrosion in water tanks.

RUSTA RESTOR will prevent further corrosion of underwater surfaces. Effective whether tank has been painted or not.

No need to shut down tank. The most effective and economical method of water tank protection.

Write today for details

RUSTA RESTOR CORP.

1480 W. State Street

FREMONT, OHIO

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

4 REASONS why more miles of cast iron water mains are jointed with LEADITE than with any other melted self-caulking material:

- MELTS EASILY
- GOES FARTHER
- SAVES TIME, LABOR, COST OF MATERIAL
- MAKES A GOOD TIGHT JOINT THAT IMPROVES WITH AGE !

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

IF Your SEWAGE effluents are high in suspended solids;

Or, you have a WATER PROBLEM;

Or, desire to RECOVER a product now wasted;

Or, you are disturbed by STREAM POLLUTION;

Or, are in any way interested in the removal of suspended solids from liquors;

You should investigate the

Laughlin Modified Rapid Sand Filter

BECAUSE, it is a simple automatic, continuous flow apparatus, designed on familiar lines, to accomplish a purpose without adding to the operator's troubles.

LAUGHLIN EQUIPMENT CORPORATION
270 Madison Ave., New York City

BEFORE CLEANING — THE NATIONAL METHOD — AFTER CLEANING

CLOGGED PIPES

Made Good as New

THE NATIONAL METHOD OF WATER MAIN CLEANING makes your old pipe practically as good as new. Every department is subject to loss through the ravages of time upon its distribution system. The cleaning out of this foreign matter inevitably leads to increased pressure and flow, improved health conditions, and lowered operating costs.

Our illustrated Booklet, "The Cleaning of Water Mains," will be sent upon request.

NATIONAL WATER MAIN CLEANING CO.
30 Church Street, New York, N. Y.

BRANCH ADDRESSES
205 West Wacker Drive, Chicago, Ill.
115 Peterboro St., Boston, Mass.
910 William Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Missouri
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Nebraska
501 Howard St., San Francisco, Calif.
2028 Union Ave., Montreal, Canada

Unbreakable Windows for Automatic Controls

● "Unbreakable" windows for many types of control instruments are now made of "Vinylite" clear plastic sheets. These windows show the operating units of "Tanktrols," automatic water-level controls for elevated tank systems; they cover the accessory depth indicators of "Floatrols," used for pump or valve control in connection with open tanks or sumps; they serve as dial windows for depth indicators on "Selectrols," complex pump controls for sewage systems.

In service, many of these controls are located in the damp atmospheres of pump houses or over open vats and sumps. Thus the primary requisites of such service are moisture resistance, permanence of form, and transparency. All these characteristics are obtained in the "Vinylite" plastics now employed by Automatic Control Company of St. Paul, Minn.

"Hastelloy—C" Available in Sheets

● The acid resistant alloy—Hastelloy "C"—has recently become available in rolled form. Recent data indicate that the alloy possesses remarkably high strength and toughness for a material having such high resistance to chemical corrosion. The rolled and annealed Hastelloy sheet, possessing tensil strength of 115,000 to 128,000 lb. per square inch, and Brinnel hardness of 160 to 210, is now available in all commercial thicknesses and sizes up to 200 lb.

Hastelloy-C, composed of nickel, molybdenum, chromium, and iron, has outstanding resistance to wet chlorine and ferric chloride.

For further information write Hayes Stellite Co., Kokomo, Indiana, or 30 East 42nd St., New York City.

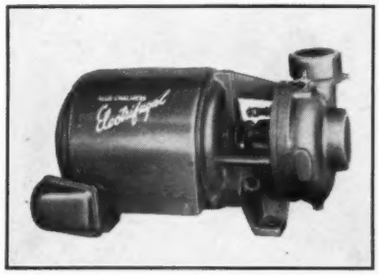
Worthington Now Offering Pressure Filters and Softening Units

● In connection with its entrance into the water purification field, the Worthington Pump and Machinery Corp. announces that it has completed research and design standards for pressure type water filters and hot process water softeners of all capacities.

Worthington's chemical and engineering departments, as well as its manufacturing facilities, have been supplemented to accommodate the particular requirements of water purification service.

It is stated by the Corporation that the new design, in combination with heaters and other water handling equipment of its manufacture, plus Worthington Service, represents certain advantages hitherto unavailable. Recent Bulletins W-210-B26 and W-210-B27 describe and picture the several interesting features of Worthington's new filter and softener line. Address Worthington Pump and Machinery Corp., Harrison, N. J.

The A-C "Electrifugal"



● Allis-Chalmers Mfg. Company announces its new "Electrifugal" pump which is an all-in-one centrifugal pump especially designed as a complete pump and motor unit on one shaft and one housing. Instead of using standard motors having special end housings and shaft extensions, the "Electrifugal" pumping unit has a special motor with a one piece cast iron motor yoke and pump bracket. The feet are cast integral with the housing and bracket and extend under the entire unit instead of under the motor only.

The special motor design, with copper bearing steel cover, meets NEMA specifications for splash proof motors. Totally enclosed, fan cooled motors and explosion proof motors are also available in the "Electrifugal" type. For normal service the pump is built with cast iron casing, bronze fitted.

In splash proof construction the "Electrifugal" pump is now available in sizes from 1 h.p. to 10 h.p. inclusive at 3,500 r.p.m. and from ¾ h.p. to 7½ h.p. inclusive at 1,750 r.p.m. for heads up to 160 feet. Larger sizes of this type are in the process of design.

For bulletin B-6040 presenting detailed information concerning the "Electrifugal" pump write Allis-Chalmers Mfg. Co., Milwaukee, Wis.

WITH THE MANUFACTURERS

Arthur Clark Joins Pomona Pump

Arthur T. Clark

● Arthur T. Clark, formerly Development and Sales Engineer in the Pipe Coatings Division of Barrett Company, and more recently employed on engineering development work by the American Water Works and Electric Co., has joined the Pomona Pump Co. as Sales Engineer.

Mr. Clark's long and varied experience in the water works field took him from manager of the Greenwich Water Company to the head office of the Community Water Service Co. as its chief engineer—this company then operating 80 properties.

At one time he handled special assignments for the National Water Main Cleaning Co. in connection with especially important or difficult main cleaning operations. To Barrett Co. he went from the position of manager of the Morristown, N. J., Water Department, to do a splendid job of introducing and further perfecting Barrett's Coal Tar Enamels for coating and lining pipes. He had many friends before, and made many more while with Barrett.

Pomona Pump Company, with plants in Pomona, Calif., and St. Louis, Mo., has during the year established an executive eastern office at 120 Broadway, New York City; made General Sales Manager C. L. Barrett, Vice-President in Charge of Sales, and W. D. Turnbull, General Sales Manager. To the New York office the company also transferred Svend A. Canariis, who had made a reputation in the field while in charge of pumping stations of the Pittsburgh Water Dept. Now, through the appointment of Arthur Clark, Pomona has added another capable water works engineer to its sales and service staff.

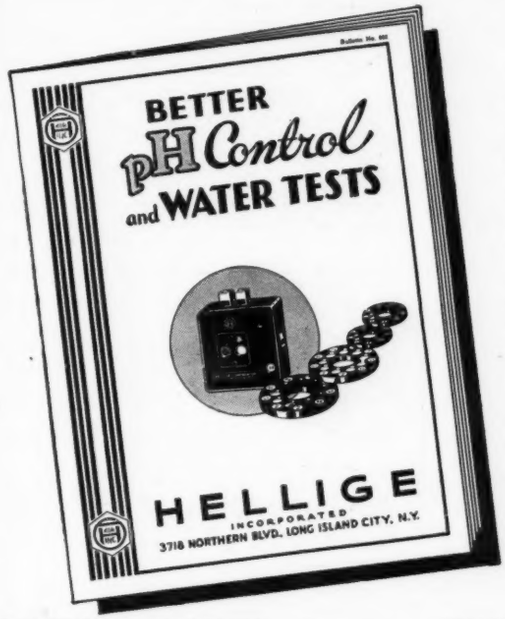
Sutliff Placed in Charge R-C's Chicago Office

● Announcement has just been made by the Roots-Connersville Blower Corp., that J. T. Sutliff has been placed in charge of the company's Chicago office.

Mr. Sutliff, who succeeds the late Wm. Townsend, has been connected with Roots-Connersville for many years. Prior to going to the Chicago office in 1935, he was located at the factory.

E. A. Coons, also a graduate engineer, will assist Mr. Sutliff in the Chicago office, which is located at 122 South Michigan Avenue.

WRITE TODAY FOR THIS INFORMATIVE FREE 28-Page BULLETIN No. 602!



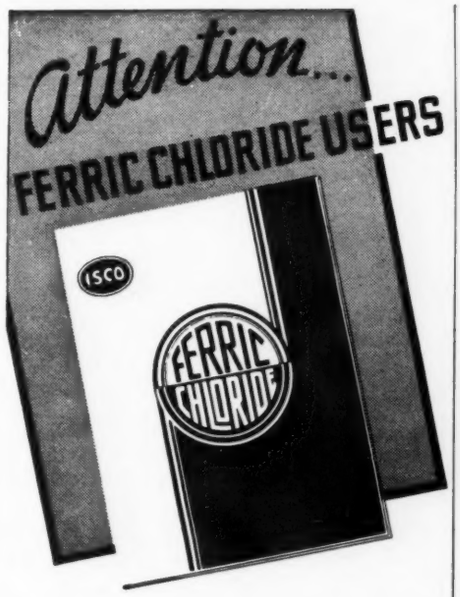
A study of this bulletin would be to your best interest, as it would enable you to form an intelligent judgment as to what is best suited for a particular purpose in extending present equipment or in planning for an initial installation.

PERPETUALLY ACCURATE GLASS COLOR STANDARDS
NOW AVAILABLE FOR

pH Control, Color of Water, Ammonia Nitrogen, Nitrite Nitrogen, Nitrate Nitrogen, Chlorine, Iron, Dissolved Oxygen, Manganese, Lead, Phosphate, Silica, and Sulphides.

HELLIGE, INC. 3718 NORTHERN BLVD. LONG ISLAND CITY, N.Y.
HEADQUARTERS FOR COLOR STANDARDS AND COLORIMETRIC APPARATUS

Attention... FERRIC CHLORIDE USERS



This brand new booklet contains a wealth of information and data which every ferric chloride user should have. A copy is yours for the asking, with our compliments.

INNIS, SPEIDEN & COMPANY
Manufacturers of
ISCO FERRIC CHLORIDE
117 Liberty St. NEW YORK
CHICAGO · CLEVELAND · BOSTON
PHILADELPHIA · GLOVERSVILLE, N.Y.
Plant: Niagara Falls, N. Y.

HYDRO-TITE

A DEPENDABLE self-caulking joint compound used to joint cast iron bell and spigot pipe. Much easier to use than lead and makes stronger, more flexible and tighter joints.

Employed on thousands of miles of pipe from 4" to 60". Write for our free trial offer.

HYDRAULIC DEVELOPMENT CORPORATION
MAIN SALES OFFICE - 50 CHURCH STREET, NEW YORK
GENERAL OFFICES AND WORKS - WEST MEDFORD STATION BOSTON, MASS.
OVER 25 YEARS WITHOUT A FAILURE

REAL SURFACE PROTECTION
with **SHERWOOD'S** specifications is
ECONOMICAL, EFFECTIVE and **DURABLE**

R S P ASPHALT EMULSION FOR ROOF COATINGS
R S P SEMI-MASTIC FOR NON-SLIP FLOORS
R S P PLASTIC FOR EXPANSION JOINTS AND CAULKING

THEY ARE NOT COAL TAR PRODUCTS

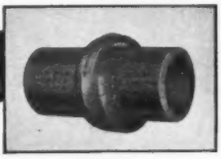
Special instructions are gladly supplied for the many uses for these exceptional products. We invite your questions on waterproofing problems of any nature and assure you of our cooperation.

SHERWOOD WATERPROOFING CORPORATION
53 PARK PLACE NEW YORK, N. Y.

When you think of
ALUM
... think of
ACTIVATED

ACTIVATED ALUM CORPORATION
Curtis Bay Baltimore, Maryland

WESTON



GASKET AND FORM
The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

- **No jute used—gasket centers spigot.**
- **Definite space in each joint for cement.**
- **Form confines cement-grout to lower portion of joint.**
- **Particularly advantageous in water-bearing trenches.**
- **Infiltration minimized.**

L. A. WESTON **Adams, Mass.**

You'll like the Lennox in St. Louis, too. Here in a handy downtown location, you'll find cheery, comfortable surroundings ... sleep-inviting beds, famous food and drink ... everything to make your stay pleasant.

All rooms have private bath and guest-controlled radio. Rates: 50% of all rooms $3.50 or less, single; $5.00 or less, double.

HOTEL **Lennox**
9th & Washington • St. Louis, Mo.
Nearby Parking and Garages

The Meter-Master
RATE RECORDER FOR WATER METERS
Send For Literature
F. S. BRAINARD & CO.
246 Palm Street, Hartford, Conn.

STOP CORROSION
with CARSON
MECHANICAL JOINTS
• CHARCOAL IRON BOLTS •
for Cast Iron Pipe and Fittings
WRITE FOR PRICES AND FURTHER INFORMATION
CARSON CADILLAC CORP.
1221 PINSON ST. BIRMINGHAM, ALA.

"G.E." Exhibits Novel Pump and Valve Control System

• At the General Electric Co.'s booth, during the recent Convention of Sewage Works Association in Chicago, was on view for the first time a working model of a new system of controlling pumping operations without use of pressure chambers, floats or other moving parts. The whole thing is done by adapting temperature change to energizing relay units in motor control systems.

The principle of the new control involves small metallic elements which are kept constantly at a temperature somewhat above that of the water or sewage to be pumped. These hermetically sealed jacketed elements are kept heated by a trickle flow of electric current through them. When the liquid level partially submerges an element the resultant cooling effect changes the characteristic of the circuit sufficiently to reduce the current flow through the relay in the control system, thereby starting the pump connected to that particular element.

As the liquid in the sump or reservoir rises or falls, other elements are submerged or exposed in turn, and pumps cut in and out to meet flow and elevation changes.

This unique and highly versatile system completely eliminates contact points, pressure switches, and moving parts generally. The elements are corrosion and gas proof and the scheme may be used to sound a high and low level alarm, or for automatic electric valve control as well as pump control.

For descriptive literature, write "G.-E," Schenectady, N. Y.

Sparling's Exchange Service

• To us Sparling's "Exchange Service" in meter maintenance was news. Although we understand that this service has now been available for some time, such service will probably be news to many of our readers, as it was to us.

The scheme amounts to this—when a Sparling Main Line Meter (propeller type) has come to the point where it is suspected that repairs or a check on accuracy loss, due to wear or other damage, may be in order the owner merely sends in the factory number and requests a replacement meter-head. Upon receipt of the requested head, replacement is made and the old head is shipped to the factory for thorough check-up and repairs, if needed.

The exchange head may be kept if desired, thus necessitating but one opening of the line—or the original head may be returned. The cost of this service is nominal, amounting to perhaps 5 per cent annual interest and depreciation on the original cost of the meterhead.

For a copy of Bul. No. 201, which describes the "Sparling Exchange Service" and lists the schedule of charge per replacement, write R. W. Sparling, 945-51 North Main Street, Los Angeles.

Churchill Hungerford, Sr., Passes

● Churchill Hungerford, Sr., Chairman of the Board of Hungerford and Terry, Inc., of Clayton, N. J., filter and softener manufacturers, passed away on October 16th, following a major operation in a Philadelphia hospital. He was the founder of the firm he headed and was very active right up to the time of his death.

Mr. Hungerford long had very definite conceptions concerning the functions and component parts of rapid sand filters, one of which was his belief in coarse grained sand, effective size 0.75 or thereabouts and a uniformity coefficient approaching unity for best filter performance and bed cleansing. Of considerable interest is the decided present trend toward what was Mr. Hungerford's early conception of a proper filter bed.

In the industrial field, in which his company installed many important water treatment plants, the name of Churchill Hungerford ranks high.

Columbia Alkali Establishes Southeastern Office

● W. I. Galliher, director of sales of the Columbia Alkali Corporation, chlorine and alkali manufacturers, has announced the establishment of another chemical sales office in the southeast in charge of J. R. Simpson of Durham, N. C.

Mr. Simpson, a native of Winston Salem, N. C., was graduated by Duke University in 1924. During his college career he was prominent in athletic affairs, having served four years on the 'varsity football squad.

After February 1, 1941, Columbia's office will be located at Charlotte, N. C.

Yeomans Bros. Establishes New England Representation

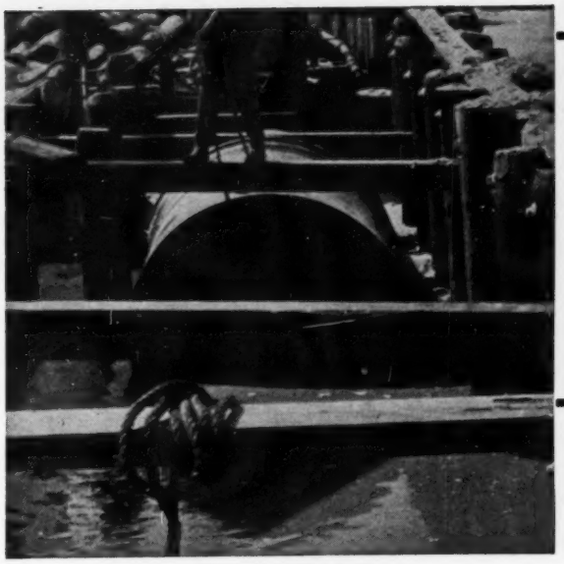
● In the New England States, Yeomans Bros. of Chicago will henceforth be represented by the long established firm (1881) the Gustavo Preston Co., 113 Broad St., Boston.

Yeomans products include centrifugal water and sewage pumps, air compressors, vacuum pumps, pneumatic sewage and solids ejectors, and several items of sewage treatment equipment.

Like their New England representatives, Yeomans Bros. Co. is also a long established manufacturing firm.

USED TRENCHER

P&H ladder-type in good condition. Equipped with Waukesha 55 h.p. gas engine. Digs 22" to 26" trench, 15' in depth. Can ship in 12 days. Reduced to $2,250 for quick sale. Write Box No. 110, Water Works & Sewerage, 330 South Wells Street, Chicago, Ill.



84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.
11 Broadway, New York

Warren Pipe Company of Mass., Inc.
75 Federal St., Boston

Prevent wear and cutting of rods, plungers, shafts and valve stems by using

MABBS RAWHIDE PACKING

In Your Water Works and Sewage Plants

IT LASTS LONGER — *Is Anti-Frictional, Saves Power, Labor and Repairs. Will prove the cheapest packing that can be bought.*

Trade Mark Reg. U. S. Pat. Off.

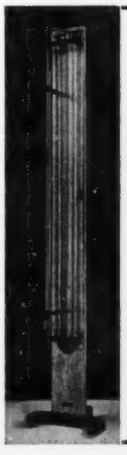
Mabbs Hydraulic Packing Co.
Incorporated 1892
431 S. Dearborn St., Chicago, U. S. A.

EDSON'S NEW HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs.

THE EDSON CORP'N
49 "D" Street
So. Boston, Mass.
NEW YORK: 142 Ashland Pl., Brooklyn
CHICAGO: 1061 Peoples Gas Building

Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories



THE ENSLOW STABILITY INDICATOR

Provides Continuous Corrosivity Index

Base weighing 12 pounds can be removed, permitting wall mounting. Well constructed throughout. Art Metal Finish.

Write for Full Details

Phipps & Bird, Inc.
RICHMOND, VA.

WILSON CHEMICAL FEEDER

Outstanding features are quick feed adjustment, visible valves, flexible cylinders; feeds against 150-lb. pressure, and proof against corrosive chemicals.

Motor driven, positive displacement, pump type feeder. It is illustrated as a constant rate feeder though also furnished as Type MD-H with fluid meter control, and when so arranged is a measure-to-measure proportioning feeder.

This is a sturdy, dependable heavy duty feeder.

Write for Bulletin

Wilson Chemical Feeders, Inc.
BUFFALO, NEW YORK

ADVERTISERS

The Dash (—) Denotes Current Advertisers Who Do Not Appear in This Issue

A

Activated Alum Corp. 84
Albright & Friel, Inc. 76
Alvord, Burdick & Howson. 76
American Brass Company, The. —
American Cast Iron Pipe Co. 78
*Armco Drainage Products Association —
Arrowhead Iron Works, Inc. —
Asphalt Products Co., Inc. —
Atlantic Steel Co. —
Atlas Mineral Products Co. of Penna., The 536B-536C- 80
*Ayer-McCarel-Reagan Clay Co. —

B

Bacharach & Co., E. W. —
Badger Meter Mfg. Co. 13
*Bailey Meter Co. 81
Barrett Company, The. —
Bender Warrick Corp. —
Benton Tool Corporation. —
Black & Veatch. 76
*Bowerston Shale Co., The. —
Brainard & Co., F. S. 84
Brown & Brown, Inc. —
Buck, Seifert and Jost. 76
*Builders Iron Foundry. 75
Burns & McDonnell Engr. Co. 76

C

Calgon, Inc. 548A
Carborundum Company, The. —
Carson-Cadillac Corporation. 84
Carter Company, Ralph B. —
Cast Iron Pipe Research Association, The 536A
Central Foundry Co. —
Centriline Corporation. —
Chain Belt Co. 16
*Champion Corporation. —
Chapman Valve Mfg. Co., The. —
Chester Engrs., The. 76
*Chicago Bridge & Iron Company. 5
*Chicago Pump Company. —
Clark Controller Co., The. 3
Cloroben Corp. —
Clow & Sons, James B. 80
Cochrane Corp. —
*Columbia Alkali Corp. —
Columbian Iron Works. 86
Corning Glass Works. —
Crane Co. 6

D

Darco Corporation. 4
De Laval Steam Turbine Co. —
Diamond Alkali Company. 71
Dorr Company, Inc., The....Third Cover
*Dow Chemical Company, The. 74
Dracco Corporation. —

E

Edson Corporation, The. 85
Eimco Corporation, The.....10-11
Electric Indicator Corporation. —
Electro Bleaching Gas Co. —
Electro Rust Proofing Co. —
Everson Manufacturing Co. —

F

Fairbanks, Morse & Co. —
*Filtration Equipment Co. —
Ford Meter Box Co. 78
Fulton, Edward A. 76

G

Gardner-Denver Company. —
General Chemical Company. —
*General Paint Corporation. —
Glamorgan Pipe & Foundry Co. —
*Golden-Anderson Valve Spec. Co. —
*Graver Tank & Mfg. Co. —
Greeley & Hansen. 76
Gruendler Crusher & Pulv. Co. —

H

Havens and Emerson. 76
Hellige, Inc. 83
*Hill, Hubbell & Co. —
Hills-McCanna Co. —
Homelite Corporation, The. —
*Hydraulic Development Corp. 83

I

*Industrial Chemical Sales.....536D
Inertol Company, Inc. —
Innis, Speiden & Co. 83
*International Filter Co. 72
Iowa Valve Company. —

J

*Jeffrey Mfg. Co. —
*Johns-Manville 9

K

Knowles, Inc., Morris. 76

L

*Lakeside Engineering Corporation. —
Lancaster Research Laboratories. 76
Laughlin Equipment Corporation. 82
Layne & Bowler Co. —
Leadite Company, The. 81
Lennox Hotel. 84
*Link Belt Co. —
Lock Joint Pipe Co. 74
Ludlow Valve Mfg. Co., Inc., The. —

M

M. & H. Valve & Fittings Co. —
Mabbs Hydraulic Packing Co. 85
Mathews Hydrants. 8
Mathieson Alkali Works, Inc., The. 7
Metcalf & Eddy. 76
Michigan Alkali Company. —
*Mueller Brass Co. —
Mueller Co. 86
Municipal Service Co. —

N

National Tube Company. 15
*National Water Main Cleaning Co. 82
National Meter Co. —
Neptune Meter Co. 18
Newsom, Reeves. 76
Nichols Engineering & Research Corp. 548B
*Northrop & Co. —
Nussbaumer & Clarke, Inc. 76

O

*Omega Machine Company. —
Ozark Chemical Company. —

P

*Pacific Flush Tank Company. 78
Pardee Engineering Company. —
*Pennsylvania Salt Mfg. Company. 14
Permutit Company, The. 73
Petersen Hydraulic Flusher Co. —
Phipps & Bird, Inc. 85
Phoenix Meter Corporation. —
Pirnie, Malcolm. 76
*Pitometer Company, The. 76
*Pittsburgh-Des Moines Steel Co. 72
Pittsburgh Equitable Meter Company —
Pollard Co., Inc., Joseph G. 78
Portland Cement Association. 12
*Proportioneers, Inc. 16

R

Raisch, William, and Associates. 76
Rapp, W. M. —
Rawlins, George S. 77
Reilly Tar & Chemical Corporation. 79
Rensselaer Valve Co. —
Riddick, Thomas M. 77
Roberts and Schaefer Co. —
Roberts Filter Mfg. Co. 78
Ross Valve Mfg. Co., Inc. —
Royer Foundry & Machine Co. —
Runyon & Carey. 77
Russell and Axon. 77
Rusta Restor Corp. 81

S

Salomon & Bro., L. A. —
*Servicised Products Corp. —
*Sherwood Waterproofing Corp. 84
*Simplex Valve & Meter Co. 77
Smith Company, S. Morgan. —
Solvay Sales Corporation. —
Stahl & Co., Inc., Lawrence. —
Standard Silicate Division. 71
Stanley Co., Inc., William W. —
Stanley Engineering Company. 77
Stewart, W. H. —
*Streamline Pipe and Fittings Division —
Syntron Co. —

T

Tamms Silica Co. —
Tapax Mfg. Co. —
Tennessee Corporation. 78
Thomson Meter Company. 18
*Turbine Sewer Machine Co. 74

U

*Underpinning & Foundation Co., Inc. —
*U. S. Pipe and Foundry Co.Second Cover
United States Steel. 15

V

Vapor Recovery Systems Company. —
Vogt Mfg. Co. —

W

*Wailes Dove-Hermiston Corporation. —
*Wallace & Tiernan Co., Inc..Back Cover
Warren Foundry & Pipe Corp. 85
Water Leak Detector Co. 77
Weston, L. A. 84
Weston and Sampson. 77
Whitman and Howard. 77
Whitman, Requardt & Smith. 77
Wiley & Sons, Inc., John. —
Wilkens-Anderson Co. —
Wilson Chemical Feeders, Inc. 85
Wood Company, R. D. 8
Worthington Pump & Machinery Corp. —

* Advertisers with * were represented in the April, 1940, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on any of their products.

Water Control Equipment

You will be interested in the complete line offered by MUELLER. Write for catalogs of the equipment in which you are interested.

MUELLER CO. . . . Decatur, Ill.

Factories: Decatur, Ill.; Chattanooga, Tenn.; Los Angeles, Calif.; Sarnia, Ont.
Branches: New York and San Francisco

A Christmas Gift to YOU

WATER WORKS & SEWERAGE will give you a subscription at half the regular rate, if your remittance is mailed with this coupon before December 15th. If you are already a subscriber your subscription will be extended.

1 Year at $1.00 (Regular rate $2.00)
2 Years at $2.00.

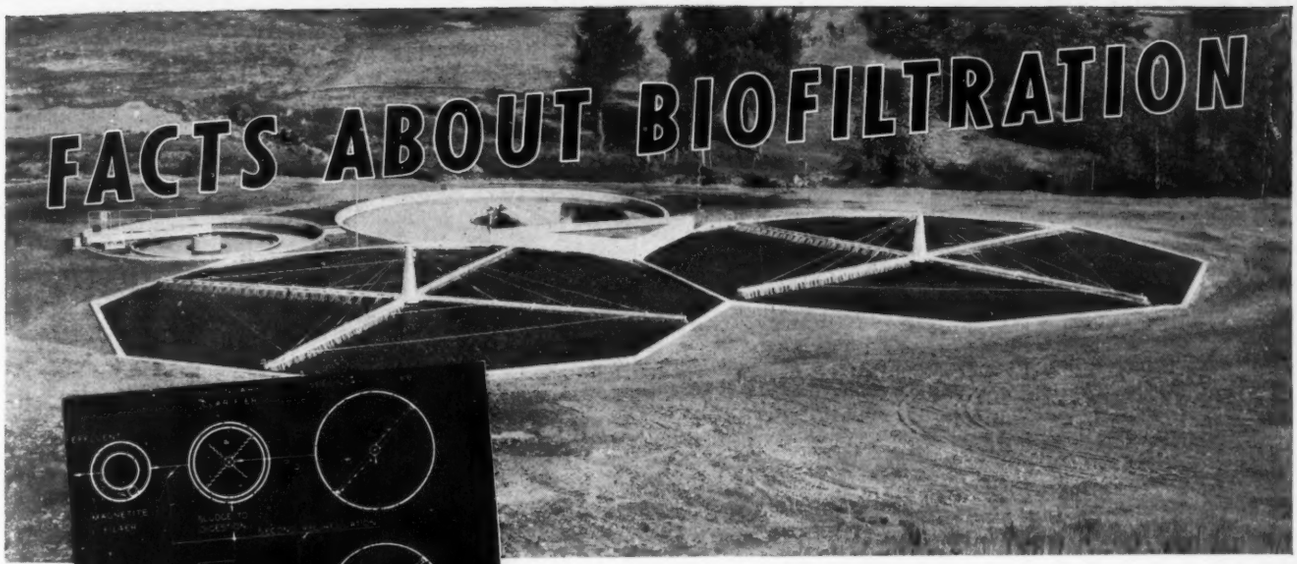
USE THIS COUPON
(Please print)

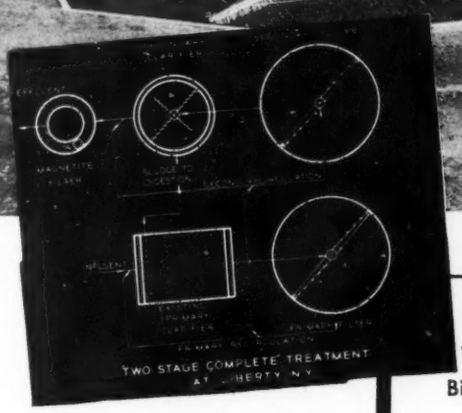
Name .....

Address .....

(Mail to 330 S. Wells St., Chicago)

FACTS ABOUT BIOFILTRATION





DORRCO

★ Twelve months ago we announced our acquisition of rights to the Biofiltration System—an entirely new method of sewage treatment.

Never in our experience has any new process aroused such broad interest among members of the profession, or been adopted so rapidly by new plants.

The facts below from initial operation at the latest installation at Liberty, N. Y. speak for themselves and answer many of the questions that sanitary engineers might like to ask us on the step by step workings of this new system.

★ WHAT IT IS

The Biofiltration System comprises a combination of a Clarifier and a Filter, wherein unthickened filter discharge is recycled back to the Clarifier. Single or Multiple Stage Systems may be employed to give results comparable with (a) Chemical Precipitation (b) Standard Trickling Filter practice or (c) Activated Sludge Process.

★ WHAT IT DOES

Compared with Standard Trickling Filter Practice

- Uniform effluent with fluctuating feed
- Filter loadings up to 10 times normal
- Shallow filters—3 ft. media depths
- Installed costs 25 to 35 percent less
- Operating costs 30 to 40 percent less

Compared with Standard Activated Sludge Treatment

- First three advantages, same as above
- Installed cost approximately the same
- Operating cost 30 to 50% less
- Expert supervision not required
- Industrial wastes readily handled

★ WHERE IT'S USED

33 installations to date—Several in successful operation for 4 years.

In California 17, Washington 5, Iowa 3, and one each in Arkansas, Georgia, Louisiana, Massachusetts, New York, Oklahoma, Oregon, Virginia.

Write for an 8 page technical report on Biofiltration and complete description of Liberty, N. Y. installation, with costs and day by day operating data.

BIOFILTRATION OPERATING DATA

Liberty, New York—Aug. 28 - Sept. 5, 1940
Averages of daily 24 hr. composite samples

Flows	
Maximum—M. G. D.	2.09
Minimum—M. G. D.	0.31
Average —M. G. D.	0.91
Suspended Solids	
Raw influent—P. P. M.	160
Final effluent—P. P. M.	10
Overall removal—percent	93.7
B. O. D.'s	
Raw influent—P. P. M.	202
Final effluent—P. P. M.	12
Overall reduction—percent	94.0
Turbidity	
Final effluent—P. P. M.	4.6
Dissolved Oxygen	
Final effluent—P. P. M.	6.0

Clarifier Data	
Primary Clarifier	
Detention—hours	1.17
Overflow rate—gal. per sq. ft. per day	1426
Secondary Clarifier	
Detention—hours	1.58
Overflow rate—gal. per sq. ft. per day	1140
Biofiltration Data	
Filter dosing rate (each filter) raw—M. G./A/D	7.8
Filter dosing rate total—M. G./A/D	27.8
Recirculation ratio	2.56
B.O.D. Loading (both filters) Lbs. per cu. yd. per day	1.34

THE DORR COMPANY INC.

ENGINEERS • 570 Lexington Ave., New York

ATLANTA • TORONTO • CHICAGO • DENVER • LOS ANGELES

DORR TECHNICAL SERVICES AND EQUIPMENT ARE ALSO AVAILABLE FROM THE FOLLOWING COMPANIES:

NETHERLANDS: Dorr-Oliver N.V. The Hague • ENGLAND: Dorr-Oliver Company Ltd., London • GERMANY: Dorr Gesellschaft, m.b.H. Berlin • FRANCE: Soc. Dorr-Oliver, Paris
ITALY: S.A.I. Dorr-Oliver, Milan • JAPAN: Sanki Eng. Co., Ltd., Tokyo • SCANDINAVIA: A.B. Hedemora, Hedemora, Sweden • AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
ARGENTINA: Luis Fiore, Buenos Aires • SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg • BRAZIL: Oscar Taves & Co., Rio de Janeiro

"WHEN YOUR NOSE STARTS
TOWARD A GLASS OF WATER"
ed, odors develop
r in.
K-POINT Chlorinati
s. In Mr. Bryan
lorination